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ALMANAC FOR COMPUTERS, 1977

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Section A: EXPLANATION

Introduction

This *Almanac for Computers* has been designed to facilitate the application of digital computers and small calculators to problems of astronomy and navigation which require coordinates of celestial bodies. For such applications the fixed-interval tabulations of the *American Ephemeris and Nautical Almanac (AE)*, the *Nautical Almanac (NA)* and the *Air Almanac (AA)*, with the inevitable requirement of interpolation, should ideally be replaced by concise mathematical expressions for direct calculations. Such expressions must take the form of mathematical approximations, however, since the precise data contained in the above publications are calculated from extensive theories which are not readily adaptable to the majority of astronomical and navigational applications. Using the expressions in this almanac, it is possible to calculate, with minimal loss of precision, the basic data in the *AE*, *NA* and *AA* for specific times and conditions. For applications not requiring the greatest accuracy, many of the expressions can be truncated to shorter forms. More specific information on precision is given in Tables 1 and 2 of this section. Truncation procedures are discussed in the explanatory material on the pages that follow.

For most efficient use with computers, the data in this almanac are available in machine readable form on punched cards or magnetic tape.

This initial, experimental edition of the *Almanac for Computers* is issued with the hopeful expectation that subsequent editions will be issued annually. While there is an indisputable need for an almanac designed for use with computers and calculators, many questions remain concerning the form and substance of such an almanac. The utility and convenience of future editions of the *Almanac for Computers* will depend to a great extent upon the suggestions of knowledgeable users. Please send inquiries, suggestions and comments to the Director, Nautical Almanac Office, U.S. Naval Observatory, Washington, D.C. 20390.

Day of Month	JANUARY			FEBRUARY			MARCH			APRIL		
	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year
	2443			2443			2443			2443		
1	144.5	Sat.	1	175.5	Tue.	32	203.5	Tue.	60	234.5	Fri.	91
2	145.5	Sun.	2	176.5	Wed.	33	204.5	Wed.	61	235.5	Sat.	92
3	146.5	Mon.	3	177.5	Thu.	34	205.5	Thu.	62	236.5	Sun.	93
4	147.5	Tue.	4	178.5	Fri.	35	206.5	Fri.	63	237.5	Mon.	94
5	148.5	Wed.	5	179.5	Sat.	36	207.5	Sat.	64	238.5	Tue.	95
6	149.5	Thu.	6	180.5	Sun.	37	208.5	Sun.	65	239.5	Wed.	96
7	150.5	Fri.	7	181.5	Mon.	38	209.5	Mon.	66	240.5	Thu.	97
8	151.5	Sat.	8	182.5	Tue.	39	210.5	Tue.	67	241.5	Fri.	98
9	152.5	Sun.	9	183.5	Wed.	40	211.5	Wed.	68	242.5	Sat.	99
10	153.5	Mon.	10	184.5	Thu.	41	212.5	Thu.	69	243.5	Sun.	100
11	154.5	Tue.	11	185.5	Fri.	42	213.5	Fri.	70	244.5	Mon.	101
12	155.5	Wed.	12	186.5	Sat.	43	214.5	Sat.	71	245.5	Tue.	102
13	156.5	Thu.	13	187.5	Sun.	44	215.5	Sun.	72	246.5	Wed.	103
14	157.5	Fri.	14	188.5	Mon.	45	216.5	Mon.	73	247.5	Thu.	104
15	158.5	Sat.	15	189.5	Tue.	46	217.5	Tue.	74	248.5	Fri.	105
16	159.5	Sun.	16	190.5	Wed.	47	218.5	Wed.	75	249.5	Sat.	106
17	160.5	Mon.	17	191.5	Thu.	48	219.5	Thu.	76	250.5	Sun.	107
18	161.5	Tue.	18	192.5	Fri.	49	220.5	Fri.	77	251.5	Mon.	108
19	162.5	Wed.	19	193.5	Sat.	50	221.5	Sat.	78	252.5	Tue.	109
20	163.5	Thu.	20	194.5	Sun.	51	222.5	Sun.	79	253.5	Wed.	110
21	164.5	Fri.	21	195.5	Mon.	52	223.5	Mon.	80	254.5	Thu.	111
22	165.5	Sat.	22	196.5	Tue.	53	224.5	Tue.	81	255.5	Fri.	112
23	166.5	Sun.	23	197.5	Wed.	54	225.5	Wed.	82	256.5	Sat.	113
24	167.5	Mon.	24	198.5	Thu.	55	226.5	Thu.	83	257.5	Sun.	114
25	168.5	Tue.	25	199.5	Fri.	56	227.5	Fri.	84	258.5	Mon.	115
26	169.5	Wed.	26	200.5	Sat.	57	228.5	Sat.	85	259.5	Tue.	116
27	170.5	Thu.	27	201.5	Sun.	58	229.5	Sun.	86	260.5	Wed.	117
28	171.5	Fri.	28	202.5	Mon.	59	230.5	Mon.	87	261.5	Thu.	118
29	172.5	Sat.	29				231.5	Tue.	88	262.5	Fri.	119
30	173.5	Sun.	30				232.5	Wed.	89	263.5	Sat.	120
31	174.5	Mon.	31				233.5	Thu.	90			

The Julian Day begins at noon.

Day of Month	MAY			JUNE			JULY			AUGUST		
	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year	Julian Date at 0h	Day of Week	Day of Year
	2443			2443			2443			2443		
1	264.5	Sun.	121	295.5	Wed.	152	325.5	Fri.	182	356.5	Mon.	213
2	265.5	Mon.	122	296.5	Thu.	153	326.5	Sat.	183	357.5	Tue.	214
3	266.5	Tue.	123	297.5	Fri.	154	327.5	Sun.	184	358.5	Wed.	215
4	267.5	Wed.	124	298.5	Sat.	155	328.5	Mon.	185	359.5	Thu.	216
5	268.5	Thu.	125	299.5	Sun.	156	329.5	Tue.	186	360.5	Fri.	217
6	269.5	Fri.	126	300.5	Mon.	157	330.5	Wed.	187	361.5	Sat.	218
7	270.5	Sat.	127	301.5	Tue.	158	331.5	Thu.	188	362.5	Sun.	219
8	271.5	Sun.	128	302.5	Wed.	159	332.5	Fri.	189	363.5	Mon.	220
9	272.5	Mon.	129	303.5	Thu.	160	333.5	Sat.	190	364.5	Tue.	221
10	273.5	Tue.	130	304.5	Fri.	161	334.5	Sun.	191	365.5	Wed.	222
11	274.5	Wed.	131	305.5	Sat.	162	335.5	Mon.	192	366.5	Thu.	223
12	275.5	Thu.	132	306.5	Sun.	163	336.5	Tue.	193	367.5	Fri.	224
13	276.5	Fri.	133	307.5	Mon.	164	337.5	Wed.	194	368.5	Sat.	225
14	277.5	Sat.	134	308.5	Tue.	165	338.5	Thu.	195	369.5	Sun.	226
15	278.5	Sun.	135	309.5	Wed.	166	339.5	Fri.	196	370.5	Mon.	227
16	279.5	Mon.	136	310.5	Thu.	167	340.5	Sat.	197	371.5	Tue.	228
17	280.5	Tue.	137	311.5	Fri.	168	341.5	Sun.	198	372.5	Wed.	229
18	281.5	Wed.	138	312.5	Sat.	169	342.5	Mon.	199	373.5	Thu.	230
19	282.5	Thu.	139	313.5	Sun.	170	343.5	Tue.	200	374.5	Fri.	231
20	283.5	Fri.	140	314.5	Mon.	171	344.5	Wed.	201	375.5	Sat.	232
21	284.5	Sat.	141	315.5	Tue.	172	345.5	Thu.	202	376.5	Sun.	233
22	285.5	Sun.	142	316.5	Wed.	173	346.5	Fri.	203	377.5	Mon.	234
23	286.5	Mon.	143	317.5	Thu.	174	347.5	Sat.	204	378.5	Tue.	235
24	287.5	Tue.	144	318.5	Fri.	175	348.5	Sun.	205	379.5	Wed.	236
25	288.5	Wed.	145	319.5	Sat.	176	349.5	Mon.	206	380.5	Thu.	237
26	289.5	Thu.	146	320.5	Sun.	177	350.5	Tue.	207	381.5	Fri.	238
27	290.5	Fri.	147	321.5	Mon.	178	351.5	Wed.	208	382.5	Sat.	239
28	291.5	Sat.	148	322.5	Tue.	179	352.5	Thu.	209	383.5	Sun.	240
29	292.5	Sun.	149	323.5	Wed.	180	353.5	Fri.	210	384.5	Mon.	241
30	293.5	Mon.	150	324.5	Thu.	181	354.5	Sat.	211	385.5	Tue.	242
31	294.5	Tue.	151				355.5	Sun.	212	386.5	Wed.	243

The Julian Day begins at noon.

Day of Month	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Julian Date at 0^h	Day of Week	Day of Year	Julian Date at 0^h	Day of Week	Day of Year	Julian Date at 0^h	Day of Week	Day of Year	Julian Date at 0^h	Day of Week	Day of Year
	2443			2443			2443			2443		
1	387.5	Thu.	244	417.5	Sat.	274	448.5	Tue.	305	478.5	Thu.	335
2	388.5	Fri.	245	418.5	Sun.	275	449.5	Wed.	306	479.5	Fri.	336
3	389.5	Sat.	246	419.5	Mon.	276	450.5	Thu.	307	480.5	Sat.	337
4	390.5	Sun.	247	420.5	Tue.	277	451.5	Fri.	308	481.5	Sun.	338
5	391.5	Mon.	248	421.5	Wed.	278	452.5	Sat.	309	482.5	Mon.	339
6	392.5	Tue.	249	422.5	Thu.	279	453.5	Sun.	310	483.5	Tue.	340
7	393.5	Wed.	250	423.5	Fri.	280	454.5	Mon.	311	484.5	Wed.	341
8	394.5	Thu.	251	424.5	Sat.	281	455.5	Tue.	312	485.5	Thu.	342
9	395.5	Fri.	252	425.5	Sun.	282	456.5	Wed.	313	486.5	Fri.	343
10	396.5	Sat.	253	426.5	Mon.	283	457.5	Thu.	314	487.5	Sat.	344
11	397.5	Sun.	254	427.5	Tue.	284	458.5	Fri.	315	488.5	Sun.	345
12	398.5	Mon.	255	428.5	Wed.	285	459.5	Sat.	316	489.5	Mon.	346
13	399.5	Tue.	256	429.5	Thu.	286	460.5	Sun.	317	490.5	Tue.	347
14	400.5	Wed.	257	430.5	Fri.	287	461.5	Mon.	318	491.5	Wed.	348
15	401.5	Thu.	258	431.5	Sat.	288	462.5	Tue.	319	492.5	Thu.	349
16	402.5	Fri.	259	432.5	Sun.	289	463.5	Wed.	320	493.5	Fri.	350
17	403.5	Sat.	260	433.5	Mon.	290	464.5	Thu.	321	494.5	Sat.	351
18	404.5	Sun.	261	434.5	Tue.	291	465.5	Fri.	322	495.5	Sun.	352
19	405.5	Mon.	262	435.5	Wed.	292	466.5	Sat.	323	496.5	Mon.	353
20	406.5	Tue.	263	436.5	Thu.	293	467.5	Sun.	324	497.5	Tue.	354
21	407.5	Wed.	264	437.5	Fri.	294	468.5	Mon.	325	498.5	Wed.	355
22	408.5	Thu.	265	438.5	Sat.	295	469.5	Tue.	326	499.5	Thu.	356
23	409.5	Fri.	266	439.5	Sun.	296	470.5	Wed.	327	500.5	Fri.	357
24	410.5	Sat.	267	440.5	Mon.	297	471.5	Thu.	328	501.5	Sat.	358
25	411.5	Sun.	268	441.5	Tue.	298	472.5	Fri.	329	502.5	Sun.	359
26	412.5	Mon.	269	442.5	Wed.	299	473.5	Sat.	330	503.5	Mon.	360
27	413.5	Tue.	270	443.5	Thu.	300	474.5	Sun.	331	504.5	Tue.	361
28	414.5	Wed.	271	444.5	Fri.	301	475.5	Mon.	332	505.5	Wed.	362
29	415.5	Thu.	272	445.5	Sat.	302	476.5	Tue.	333	506.5	Thu.	363
30	416.5	Fri.	273	446.5	Sun.	303	477.5	Wed.	334	507.5	Fri.	364
31				447.5	Mon.	304				508.5	Sat.	365

The Julian Day begins at noon.

Section C contains mathematical representations of data published in the *American Ephemeris and Nautical Almanac (AE)*. Chebyshev expansions have been chosen as the means of representation since they provide efficient and accurate expressions that can be easily evaluated with a small computer. The coefficients a_i of the Chebyshev expansion

$$f(x) = a_0/2 + \sum_{i=1}^{n} a_i T_i(x)$$

are tabulated for prescribed time spans, where $f(x)$ is the function being represented, $T_i(x)$ is the Chebyshev polynomial of the first kind of the *i-th* degree, and x is the normalized time variable. Although Chebyshev polynomials appear in the formal series expansions, the series can be evaluated without explicitly calculating these polynomials. The user need have no *a priori* knowledge of Chebyshev analysis.

It must be emphasized that the series are valid only over the specified time intervals. Attempts to extrapolate data using these series will only result in disaster.

An advantageous feature of approximations in Chebyshev series is that a reliable estimate can be made of the precision of the approximation. Using the full series as published will provide values of the astronomical functions to a precision comparable to that published in the *AE*. However, in the frequent cases in which values calculated from the series differ slightly from the *AE*, it should be understood that the *AE* represents the standard. Table 1 lists the largest errors resulting from evaluating and comparing the full series with the data printed in the *AE*. If lower precision is sufficient, the series can be truncated according to the following precept to obtain shorter series with the desired precision. Beginning with the last coefficient, add the absolute values of the coefficients until the required limit of precision is accumulated. The series may be safely truncated at this point.

Example: Find the number of terms required to calculate the apparent right ascension of the Sun to a precision of $\pm 1^s$ ($=\pm 0^h.00028$) during the period 1 April through 4 July 1977.

The required series coefficients are found on page C5. Summing the absolute values of coefficients 23 through 7 for the Sun's right ascension gives a total of $0^h.00016$; adding to this the absolute value of coefficient 6 increases the total to $0^h.00032$, which exceeds the limit of precision. Therefore terms 7 through 23 can be safely dropped, and terms 0 through 6 will yield right ascensions to approximately $\pm 1^s$ during this period.

To evaluate the approximations, one must first normalize the time variable to the interval for which the series is valid. The normalized time x is to

Table 1: Comparison of *Almanac for Computers* and *AE*

Function		No. of Terms	Span of Validity	Maximum Error
Apparent Sidereal Time at 0^h UT		34	95 days	$0^s.001$
Equation of the Equinoxes		"	"	$0^s.001$
Nutation in Longitude		"	"	$0''.01$
Nutation in Obliquity		"	"	$0''.004$
Sun:	Right Ascension	24	"	$0^s.01$
	Declination	"	"	$0''.1$
	Geocentric Distance	"	"	2×10^{-7} AU
	Semi-Diameter	"	"	$0''.01$
	Ephemeris Transit	"	"	$0^s.01$
Moon:	Right Ascension	36	32 days	$0^s.002$
	Declination	"	"	$0''.01$
	Horizontal Parallax	"	"	$0''.00$
	Geocentric Rectangular Coords.	"	"	1×10^{-6} Earth's radii
Mercury:	Right Ascension	30	95 days	$0^s.03$
	Declination	"	"	$0''.2$
	Geocentric Distance	"	"	1×10^{-6} AU
Venus:	Right Ascension	"	"	$0^s.01$
	Declination	"	"	$0''.1$
	Geocentric Distance	"	"	1×10^{-6} AU
Mars:	Right Ascension	22	"	$0^s.01$
	Declination	"	"	$0''.1$
	Geocentric Distance	"	"	1×10^{-6} AU
Jupiter:	Right Ascension	"	"	$0^s.011$
	Declination	"	"	$0''.11$
	Geocentric Distance	"	"	1×10^{-6} AU
Saturn:	Right Ascension	"	"	$0^s.011$
	Declination	"	"	$0''.11$
	Geocentric Distance	"	"	1×10^{-6} AU
Uranus:	Right Ascension	"	"	$0^s.011$
	Declination	"	"	$0''.11$
	Geocentric Distance	"	"	9×10^{-6} AU
Neptune:	Right Ascension	"	"	$0^s.014$
	Declination	"	"	$0''.11$
	Geocentric Distance	"	"	9×10^{-6} AU
Pluto:	Right Ascension (Astrometric)	"	"	$0^s.000$
	Declination (Astrometric)	"	"	$0''.00$
	Geocentric Distance	"	"	1×10^{-6} AU

be determined from a relation of the form $x = t/A + B$, where values of A and B are given for each set of coefficients and t is reckoned in days and fractions thereof from 0 January. If correctly calculated, the value of x will fall in the range $-1 \leqslant x \leqslant +1$.

For the functions Apparent Sidereal Time at 0^h UT, the Equation of the Equinoxes, Nutation in Longitude and Nutation in Latitude, the variable t is measured in days of Universal Time from 0 January, 0^h UT. For all other functions in Section C, t is measured in days of ephemeris time from 0 January, 0^h ET. These latter functions can be evaluated for Universal Times, however, by using the normalizing relation $x = (t' + \Delta T)/A + B$, where t' is the Universal Time measured in days from 0 January, 0^h UT. As this volume goes to press, $\Delta T = 47^s.9$ ($=0^d.00055440$) appears to be a reliable value to use in 1977. Care should be taken to note whether the sum $t' + \Delta T$ falls outside the time span for which the series is valid. If it does, the series and constants for the next span should be used.

Once the normalized time variable x is determined, the approximation

$$f(x) = a_0/2 + \sum_{i=1}^{n} a_i T_i(x)$$

where the a_i are the printed coefficients, can be evaluated as follows:

let $b_{n+1} = b_{n+2} = 0$,
calculate $b_i = 2x b_{i+1} - b_{i+2} + a_i$, for $i = n, n-1, \ldots, 0$,
then $f(x) = (b_0 - b_2)/2$.

Example: Calculate the apparent right ascension of the Sun to a precision of $\pm 1^s$ at $13^h\ 31^m\ 00^s$ ($=0^d.563194$) UT on 7 May 1977.

From the previous example we know that terms 0 through 6 must be carried to ensure a precision of $\pm 1^s$ on this date. From the calendar (page A3) it is seen that 7 May is day 127. Since the series for the solar coordinates are based on ephemeris time, it is necessary to add ΔT to the specified Universal Time. Therefore $t = 127 + 0.563194 + 0.000554 = 127.563748$. On page C5 are found the constants $A = 47.5$ and $B = -2.91578947$. Therefore $x = 127.563748/47.5 - 2.91578947 = -0.23023688$. With this value of x and the coefficients from page C5, the algorithm works as follows:

$$\begin{aligned}
b_{n+2} &= b_8 = 0 \\
b_{n+1} &= b_7 = 0 \\
b_n &= b_6 = 2x b_7 - b_8 + a_6 = +0.0001579 \\
b_5 &= 2x b_6 - b_7 + a_5 = -0.0000400 \\
b_4 &= 2x b_5 - b_6 + a_4 = -0.0050927 \\
b_3 &= 2x b_4 - b_5 + a_3 = -0.0044990 \\
b_2 &= 2x b_3 - b_4 + a_2 = +0.0726185 \\
b_1 &= 2x b_2 - b_3 + a_1 = +3.1020839 \\
b_0 &= 2x b_1 - b_2 + a_0 = +5.9927126
\end{aligned}$$

$$f(x) = (b_0 - b_2)/2 = (5.9927126 - 0.0726185)/2$$
$$\text{RA} = 2^{h}.9600470 = 2^{h}\ 57^{m}\ 36^{s}$$

Navigational Tables

Section D contains mathematical representations of the following functions that are tabulated in the *Nautical Almanac (NA)*: the GHA of Aries; the GHA and declination of the Sun, Moon, and navigational planets; the semi-diameter of the Sun and Moon; and the horizontal parallax of the Moon. These functions are represented by two different methods that give the same results; the navigator may choose between them according to circumstances or personal taste. Both methods employ six-term series to represent the data over specified time intervals. While the series are designed to provide precision comparable to that published in the *NA*, there will be frequent but small discrepencies between the tabulated values and the values calculated from the series. In such cases it should be understood that the *NA* represents the standard. Table 2 lists the discrepencies found from evaluating and comparing the series with the data printed in the *NA*.

Under no circumstances should the series be used to extrapolate data beyond the specified time interval. Such attempts will only result in disaster.

In accordance with standard practice for navigational almanacs, the time argument used in this section is Greenwich Mean Time (GMT) or more specifically UT1. To obtain full precision in the determined positions, the radio time signals in UTC must be corrected to UT1, or GMT, according to standard procedures.

To evaluate the series the user must first convert GMT to a normalized time that is valid only over the interval of the representation. This conversion is made through the relation $x = t/A + B$, where x is the normalized time, A and B are constants specified for each time span, and t is the GMT measured in days and fractions thereof from 0 January, 0^{h} GMT. A calendar is provided on pages A2–A4 to facilitate conversion of the calendar date to the day of the year. If correctly calculated, the value of x will fall in the range $-1 \leqslant x \leqslant +1$.

Example: Calculate the normalized time x in order to calculate the position of the Sun at $15^{h}\ 22^{m}\ 00^{s}$ GMT ($=0^{d}.6402778$) on 2 November 1977.

From the calendar on page A4, 2 November is found to be day 306. Therefore $t = 306 + 0.6402778$. This date is in the interval 28 October through 16 November (days 301–320) for which series for solar coordinates are given on page D8. The constants for this interval are $A = 10.0$ and $B = -31.1$. Therefore $x = 306.6402778/10.0 - 31.1 = -0.4359722$.

Method 1: Chebyshev Series. On each page of Section D a set of Chebyshev coefficients is given for the expression $f(x) = a_0/2 + a_1 T_1(x) + a_2 T_2(x) + a_3 T_3(x) + a_4 T_4(x) + a_5 T_5(x) = a_0/2 + \sum_{i=1}^{5} a_i T_i(x)$. In this expression $f(x)$

Table 2: Comparison of *Almanac for Computers* with *NA*

Function		No. of Terms	Span of Validity	Maximum Error
GHA of Aries		6	20 days	0′.1
Sun:	GHA	"	"	0′.1
	Declination	"	"	0′.1
	Semi-Diameter	"	"	0′.1
Moon:	GHA	"	6 days	0′.2
	Declination	"	"	0′.2
	Horizontal Parallax	"	"	0′.1
	Semi-Diameter	"	"	0′.1
Navigational Planets:	GHA	"	15 days	0′.2
	Declination	"	"	0′.2

is the value of the function calculated for the normalized time x, the a_i's are the Chebyshev coefficients, and $T_i(x)$ is the Chebyshev polynomial of the first kind and the *i-th* degree. Although Chebyshev polynomials appear in this formal representation of the series, the series can be evaluated without explicitly calculating the polynomials. The user needs no *a priori* knowledge of Chebyshev analysis to evaluate the series.

One advantage of Chebyshev series is that the series can be truncated to obtain a shorter series of lower, predictable precision. This can be done as follows: beginning with the last coefficient, add the absolute values of the coefficients until the required limit of precision is accumulated. The series may be truncated at this point.

Example: Find how many terms are needed to calculate the declination of the Sun to ±0°.05 on 2 November 1977.

The required Chebyshev coefficients are found on page D8. Summing the absolute values of coefficients 5 through 3 gives a total of 0°.0051. Adding the absolute value of coefficient 2 increases the total to 0°.1177, which exceeds the limit of precision. Therefore terms 3 through 5 may be safely dropped, and terms 0 through 2 will yield the Sun's declination to better than ±0°.05.

The approximation $f(x) = a_0/2 + \sum_{i=1}^{n} a_i T_i(x)$, where n designates the last term of the series ($n \leqslant 5$), can now be evaluated as follows:

let $b_{n+1} = b_{n+2} = 0$,
calculate $b_i = 2x b_{i+1} - b_{i+2} + a_i$, for $i = n, n-1, \ldots, 0$,
then $f(x) = (b_0 - b_2)/2$.

Calculations of GHA will often produce values in excess of 360°. Such values should be reduced to the range 0° – 360° by subracting multiples of 360°.

Example: Calculate the declination of the Sun at $15^h.22^m00^s$ GMT on 2 November 1977 to a precision of ±0°.05.

From the first example of this section, $x = -0.4359722$.
From the preceding example, we know that terms 0 through 2 will provide adequate precision, so that $n = 2$.

$$
\begin{aligned}
b_{n+2} &= b_4 = 0 \\
b_{n+1} &= b_3 = 0 \\
b_n &= b_2 = 2x b_3 - b_4 + a_2 = +0.1126 \\
&\quad b_1 = 2x b_2 - b_3 + a_1 = -3.0502 \\
&\quad b_0 = 2x b_1 - b_2 + a_0 = -29.5867 \\
f(x) &= (b_0 - b_2)/2 = (-29.5867 - 0.1126)/2 \\
&\quad \text{declination} = -14°.8
\end{aligned}
$$

Example: Calculate the GHA of the Sun at $15^h\ 22^m\ 00^s$ GMT on 2 November 1977 to full precision.

As in the previous example, $x = -0.4359722$. For full precision, $n = 5$.

$$b_{n+2} = b_7 = 0$$
$$b_{n+1} = b_6 = 0$$
$$b_n = b_5 = 2xb_6 - b_7 + a_5 = -0.0002$$
$$b_4 = 2xb_5 - b_6 + a_4 = +0.0006$$
$$b_3 = 2xb_4 - b_5 + a_3 = -0.0006$$
$$b_2 = 2xb_3 - b_4 + a_2 = -0.0873$$
$$b_1 = 2xb_2 - b_3 + a_1 = +3599.9464$$
$$b_0 = 2xb_1 - b_2 + a_0 = +4429.1127$$
$$f(x) = (4429.1128 + 0.0873)/2 = 2214^\circ.6000$$
$$\text{GHA} = 54^\circ.6000 = 54^\circ\ 36'.0$$

Method 2: Power Series. As an alternative to the Chebyshev series, coefficients are given under the heading "Powers of Time Coefficients" for power series of the form $f(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5$, where x is the normalized time and the a_i's are the power series coefficients. Although the power series are easier to evaluate on hand calculators than Chebyshev series, the power series cannot be reliably truncated. In most navigational applications requiring full precision, the power series method is recommended. The series may be efficiently evaluated as follows:

let $b_5 = xa_5$
calculate $b_i = x(a_i + b_{i+1})$, for $i = 4, 3, 2, 1$
then $f(x) = a_0 + b_1$

Example: Calculate the GHA of the Sun at $15^h\ 22^m\ 00^s$ GMT on 2 November.

As in the previous examples, $x = -0.4359722$.

$$b_5 = xa_5 = +0.0015$$
$$b_4 = x(a_4 + b_5) = -0.0020$$
$$b_3 = x(a_3 + b_4) = -0.0005$$
$$b_2 = x(a_2 + b_3) = +0.0776$$
$$b_1 = x(a_1 + b_2) = -1569.4769$$
$$f(x) = a_0 + b_1 = 3784.0768 - 1569.4769 = 2214^\circ.5999$$
$$\text{GHA} = 54^\circ.5999 = 54^\circ\ 36'.0$$

When calculating the GHA it is again necessary to reduce the final result to the range $0^\circ - 360^\circ$.

Stellar Tables

The Stellar Tables (Section E) list the mean and apparent places of 176 stars for the year 1977, along with coefficients for converting from mean to apparent place for any date in the year. The list of stars is essentially the same as that for the star tables on pages 268–273 of the *Nautical Almanac*. The stars are arranged in order of increasing right ascension (decreasing sidereal hour angle), except where both components of a binary system are listed, in which case the brighter component is listed first. For binary stars which can be resolved in small instruments, the position of one or both components is listed rather than the position of the center of gravity or the center of light. For convenience to navigators the sidereal hour angle (SHA) is tabulated rather than right ascension (RA); astronomers can obtain the right ascension in degrees from the relation RA = 360° – SHA.

The quantities tabulated for each star are, from left to right:

(1) An identification number.

(2) The navigational star number, if the star is one of the 57 selected navigational stars listed in the *Nautical Almanac* and *Air Almanac*.

(3) The star name. The Bayer designation is on the first line and the proper name, if any, is on the second line.

(4) The visual magnitude.

(5) The spectral type. * indicates a composite spectrum.

(6) The mean place of the star for 1977.0. SHA in degrees and minutes is on the first line, and declination in degrees and minutes is on the second line.

(7) Four coefficients, H, R, S and C, in minutes of arc, for conversion from mean place to apparent place. The coefficients on the first line are for the conversion of SHA; these will hereafter be designated H_S, R_S, S_S and C_S. The coefficients on the second line are for the conversion of declination; these will hereafter be designated H_D, R_D, S_D and C_D.

(8) The apparent place of the star for 1977.5. SHA in degrees and minutes is on the first line, and declination in degrees and minutes is on the second line.

The mean place of a star is to be regarded as a fundamental reference point with no simple geometric or observational significance. The apparent place of a star is the geocentric position, referred to the true equator and equinox of date, at which the star will be observed. The apparent place is the position needed for navigational purposes, the calibration of telescope setting circles, the computation of transit times, *etc*. The apparent place of a star changes during the year, but for work requiring accuracies of no better than ±1′.3, the tabulated apparent place for 1977.5 can be used for any date in 1977. To obtain the apparent place of a star to greater accuracy, the following procedures should be used:

For the desired date in 1977, determine τ, the fraction of the year elapsed. If the day number t is read from the Calendar (pages A2–A4), τ can be calculated from the quantities A and B listed at the beginning of the table: $\tau = t/A + B$.

Star positions accurate to better than ±0.′5 can then be obtained by using the following formulas:

$$\text{apparent SHA} = \text{mean SHA} + H_S + R_S\tau$$
$$\text{apparent decl.} = \text{mean decl.} + H_D + R_D\tau$$

Star positions accurate to better than ±0.′1 (and generally better than ±0.′05) can be obtained by using the following formulas:

$$\text{apparent SHA} = \text{mean SHA} + H_S + R_S\tau + S_S\sin 2\pi\tau + C_S\cos 2\pi\tau$$
$$\text{apparent decl.} = \text{mean decl.} + H_D + R_D\tau + S_D\sin 2\pi\tau + C_D\cos 2\pi\tau$$

The tablulated apparent places for 1977.5 were calculated using these latter formulas with $\tau = 0.500$.

Example: Find the apparent place of Aldebaran (α Tauri) on 12 November 1977 to an accuracy of 0.′1.

From the calendar on page A4, 12 November is found to be day number 316. From page E1, $A = 365.0000$ and $B = -0.0027$. Therefore $\tau = 316/365.0000 - 0.0027 = 0.863$, $2\pi\tau = 5.4225$ radians = 310.°7, $\sin 2\pi\tau = -0.7583$, and $\cos 2\pi\tau = 0.6519$. Then, using the data on Aldebaran found on page E2 (Aldebaran is star number 26) we find:

Mean SHA		291° 21.′02	Mean decl.		+16° 27.′85
$+H_S$	−	0.16	$+H_D$	−	0.10
$+R_S\tau$	−	0.67	$+R_D\tau$	+	0.08
$+S_S\sin 2\pi\tau$	−	0.14	$+S_D\sin 2\pi\tau$	+	0.04
$+C_S\cos 2\pi\tau$	−	0.20	$+C_D\cos 2\pi\tau$	+	0.02
Apparent SHA		291° 19.′85	Apparent decl.		+16° 27.′89

The above apparent place differs from the apparent place given in *Apparent Places of Fundamental Stars, 1977* by less than 0.′05 = 3″.

Section B: APPLICATIONS

This section contains some formulas and algorithms of general utility in astronomy and navigation.

Sunrise, Sunset and Twilight

The following algorithm provides a means of calculating times of sunrise, sunset and twilight for the current year for specified locations. Between latitudes 65° North and 65° South the phenomena can be calculated to an accuracy of $\pm 2^m$. Although the algorithm can be used at higher latitudes, its accuracy deteriorates near dates when the Sun remains above or below the horizon for more than twenty-four hours.

Notation:
- ϕ = latitude of observer (north is positive; south is negative)
- λ = longitude of observer (west is positive; east is negative)
- M = Sun's mean anomaly
- L = Sun's true longitude
- a = Sun's right ascension
- δ = Sun's declination
- H = Sun's local hour angle
- z = Sun's zenith distance at rise, set or twilight *
- t = approximate time of phenomenon in days since Jan. 0, 0^h UT
- T = local mean time of phenomenon
- UT = Universal Time of phenomenon

*The proper value of z should be chosen from the following:

	z	$\cos z$
Sunrise and Sunset	90° 50′	−0.01454
Civil Twilight	96°	−0.10453
Nautical Twilight	102°	−0.20791
Astronomical Twilight	108°	−0.30902

Formulas for 1977:

(1) $M = 0.^\circ 985600t - 2.^\circ 997$

(2) $L = M + 1.^\circ 916 \sin M + 0.^\circ 020 \sin 2M + 282.^\circ 548$

(3) $\tan a = 0.91746 \tan L$

(4) $\sin \delta = 0.39782 \sin L$

(5) $\cos H = (\cos z - \sin \delta \sin \phi)/\cos \delta \cos \phi$

(6) $T = H + a - 0.^h 065710t - 6.^h 636$

(7) $UT = T + \lambda$

Procedure:

1. With an initial value of t, calculate M from eq. (1) and then L from eq. (2). If a morning phenomenon (sunrise or the beginning of morning twilight) is being calculated, construct an initial value of t from the formula $t = d + (6^h + \lambda)/24$, where d is the day of the year (see the calendar on pages A2 through A4) and λ is the observer's longitude expressed in hours. If an evening phenomenon is being calculated, let $t = d + (18^h + \lambda)/24$.
2. Solve eq. (3) for a, noting that a is in the same quadrant as L. Transform a to hours for later use in eq. (6).

3. Solve eq. (4) for $\sin\delta$ which appears in eq. (5); $\cos\delta$, which also is required for eq. (5), should be determined from $\sin\delta$. While $\sin\delta$ may be positive or negative, $\cos\delta$ is always positive.
4. Solve eq. (5) for H. If a morning phenomenon is being calculated, H is in quadrant 4 when $\cos H$ is positive, but in quadrant 3 when $\cos H$ is negative. If an evening phenomenon is being calculated, H is in quadrant 1 when $\cos H$ is positive, but in quadrant 2 when $\cos H$ is negative. Convert H from degrees to hours for use in eq. (6).
5. Calculate T from eq. (6), recalling that H and α must be expressed in hours. If T is negative or greater than 24^h, it should be converted to the range $0^h - 24^h$ by adding or subtracting multiples of 24^h.
6. Calculate UT from eq. (7), where λ must be expressed in hours. UT is an approximation to the time of sunrise, sunset or twilight, referred to the Greenwich meridian. If UT is greater than 24^h, the phenomenon occurs on the following day, Greenwich time. If UT is negative, the phenomenon occurs on the previous day, Greenwich time.

To ensure that precision is not lost during the calculations, t should be carried to four decimal places. Angles should be expressed to three decimals of a degree and, upon conversion, to three decimals of an hour. Five significant digits should be carried for the trigonometric functions.

Eq. (5) may yield a value of $|\cos H| > 1$. Although this is mathematically embarrassing, it indicates the absence of the phenomenon on that day. At far northern latitudes, for example, there is continuous illumination during certain summer days and continuous darkness during winter days.

Example: Calculate the time of sunset on 30 July at Washington, D.C.

Latitude = 38° 54′ North Longitude = 77° 04′ West

$\lambda = +77.^\circ067/15 = +5.^h138$

$\phi = +38.^\circ9 \qquad \sin\phi = 0.62796 \qquad \cos\phi = 0.77824$

For sunset $z = 90^\circ\,50'$ and $\cos z = -0.01454$

$t = 211^d + (18^h + 5.^h138)/24 = 211.^d9641$

$M = 0.^\circ985600(211.9641) - 2.^\circ997 = 205.^\circ915$

$L = 205.^\circ915 + 1.^\circ916(-0.43703) + 0.^\circ020(0.78618) + 282.^\circ548$
$= 487.^\circ641 = 127.^\circ641$

$\tan\alpha = 0.91746(-1.29659) = -1.18957$

$\alpha = 130.^\circ052 = 8.^h670$

$\sin\delta = 0.39782(0.79185) = 0.31501$

$\cos\delta = 0.94909$

$\cos H = [-0.01454 - (0.31501)(0.62796)]/(0.94909)(0.77824)$
$= -0.28750$

Since sunset is being calculated and $\cos H$ is negative, H is in the second quadrant: $H = 106.^\circ708 = 7.^h114$

$T = 7.^h114 + 8.^h670 - 0.^h065710(211.9641) - 6.^h636 = -4.^h780$
$= 19.^h220$

$UT = 19^h.220 + 5^h.138 = 24^h.358$

Sunset occurred at 0021 UT on 31 July = 2021 EDT on 30 July.

Example: Calculate the beginning of nautical twilight on 12 January at latitude 62°.5 South, longitude 7°.0 East.

$\lambda = -7°.0/15 = -0^h.467$

$\phi = -62°.5 \qquad \sin\phi = -0.88701 \qquad \cos\phi = 0.46175$

For nautical twilight $z = 102°$ and $\cos z = -0.20791$

$t = 12^d + (6^h - 0^h.467)/24 = 12^d.2305$

$M = 0°.985600\,(12.2305) - 2°.997 = 9°.057$

$L = 9°.057 + 1°.916\,(0.15742) + 0°.020\,(0.31092) + 282°.546$ 8/

$= 291°.911$

$\tan a = 0.91746\,(-2.48622) = -2.28101$

$a = 293°.673 = 19^h.578$

$\sin\delta = 0.39782\,(-0.92777) = -0.36908$

$\cos\delta = 0.92940$

$\cos H = [-0.20791 - (-0.36908)(-0.88701)]/(0.92940)(0.46175)$

$= -1.24732$

Since the calculated absolute value of $\cos H$ is greater than 1, which is outside the range of validity, there is no beginning time for morning nautical twilight on this date.

Moonrise and Moonset

Times of moonrise and moonset can be calculated for specified locations using the following algorithm. Between latitudes 60° North and 60° South the phenomena can be calculated to an accuracy of $\pm 5^m$. Although the algorithm can be used at higher latitudes, its accuracy deteriorates near dates when the Moon remains above or below the horizon for more than twenty-four hours.

Notation:

ϕ = latitude of observer (north is positive; south is negative)

λ = longitude of observer (west is positive; east is negative)

t_i = *i-th* approximation to Universal Time of phenomenon, expressed in days from January 0, 0^h UT

GHA_i = Moon's GHA at time t_i

δ_i = Moon's declination at time t_i

τ_i = *i-th* correction to t_0, thus $t_i = t_0 + \tau_i$

H_i = approximation to Moon's LHA at time of rise or set

ΔH_i = approximation to Moon's daily rate of change in GHA

Formulas:

(1) $\Delta H_i = (GHA_i - GHA_0)/\tau_i$ for $i = 0$, let $\Delta H_0 = 347°.81$

(2) $\cos H_{i+1} = (0.00233 - \sin\phi \sin\delta_i)/\cos\phi \cos\delta_i$

(3) $\tau_{i+1} = (H_{i+1} - H_0)/\Delta H_i$

(4) $t_{i+1} = t_0 + \tau_{i+1}$

Procedure:

1. Let $t_0 = d + (12^h + \lambda)/24$, where d is the day of the year (see the calendar on pages A2–A4) and λ is the observer's longitude expressed in hours. Set $i = 0$ and begin the following iterative process.
2. Using the series on pages D24–D54, calculate the Moon's GHA and declination for t_i. (Pages A8–A11 give procedures for evaluating the series for the Moon's position.) Label the calculated quantities GHA_i and δ_i, respectively, where i specifies the iteration number. For $i = 0$, calculate $H_0 = GHA_0 - \lambda$.
3. If $i = 0$, let $\Delta H_0 = 347.^\circ 81$. Otherwise calculate ΔH_i from eq. (1). If $\Delta H_i < 0$, add $360^\circ/|\tau_i|$ to ΔH_i.
4. Solve eq. (2) for H_{i+1}. In the case of moonrise H_{i+1} is in quadrant 4 when $\cos H_{i+1} > 0$, and in quadrant 3 when $\cos H_{i+1} < 0$. In the case of moonset H_{i+1} is in quadrant 1 when $\cos H_{i+1} > 0$, and in quadrant 2 when $\cos H_{i+1} < 0$. For latitudes $|\phi| > 60^\circ$, the condition $|\cos H_{i+1}| > 1$ may occur. This indicates the absence of the phenomenon on that day.
5. Calculate τ_{i+1} from eq. (3). If $|\tau_{i+1}| > 0^d.5$, the phenomenon being calculated falls on the previous day (if τ_{i+1} is negative) or on the next day (if τ_{i+1} is positive). In this case try to bring τ_{i+1} into the range $|\tau_{i+1}| < 0^d.5$ by adding to τ_{i+1} (if τ_{i+1} is negative) or subtracting from τ_{i+1} (if τ_{i+1} is positive), $360^\circ/\Delta H_i$. Two conditions may prevent the reduction of τ_{i+1} to the desired range: (1) for low values of i, τ_{i+1} may be a fairly crude approximation to the true value; and (2) each month there is one day (near last quarter) on which there is no moonrise, and another (near first quarter) on which there is no moonset. If $|\tau_{i+1}| \approx 0^d.5$, it is probably worth attempting another iteration to see if $|\tau_{i+2}| < 0^d.5$.
6. Calculate t_{i+1} from eq. (4). If $|t_{i+1} - t_i| < 0^d.01$, t_{i+1} is accurate to $\pm 5^m$. Otherwise it is necessary to iterate the solution by setting $i = i + 1$ and executing steps 2 through 6 again.

Example: Calculate the time of moonrise on 13 January 1977 at Washington, D.C. Latitude = 38° 54′ North; longitude = 77° 04′ West.

$\lambda = +77.^\circ 067 = +5^h.138$

$\phi = +38.^\circ 9 \qquad \sin\phi = 0.62796 \qquad \cos\phi = 0.77824$

From the calendar on page A2, 13 January is seen to be day 13, so

1408/ $t_0 = 13^d + (12^h + 5^h.138)/24 = 13^d.70833$

$i = 0$: Evaluating the series on page D25 for t_0,

$GHA_0 = 155.^\circ 323 \qquad \delta_0 = -12.^\circ 700$

$H_0 = 155.^\circ 323 - 77.^\circ 067 = 78.^\circ 256$

$\Delta H_0 = 347.^\circ 81$

$\cos H_1 = [0.00233 - (0.62796)(-0.21985)]/(0.77824)(0.97553)$
$= 0.18492$

Since moonrise is sought and $\cos H_1$ is positive, H_1 is in quadrant 4:

$H_1 = 280.^\circ 656$

$\tau_1 = (280^\circ.656 - 78^\circ.256)/347^\circ.81 = 0^d.5819$
Since $|\tau_1| > 0^d.5$, we try
$\tau_1 = 0^d.5819 - (360^\circ/347^\circ.81) = -0^d.4531$, which is satisfactory.
$t_1 = 13^d.7083 - 0^d.4531 = 13^d.2552 = 13$ January, 0608 UT

$i = 1$: Evaluating the series on page D25 for t_1,
$GHA_1 = 358^\circ.064 \qquad \delta_1 = -11^\circ.020$
$\Delta H_1 = (358^\circ.064 - 155^\circ.323)/(-0^d.4530) = -447^\circ.552$
Since a negative value cannot be used, we set
$\Delta H_1 = -447^\circ.552 + 360^\circ/0^d.4530 = 347^\circ.150$
$\cos H_2 = [0.00233 - (0.62796)(-0.19115)]/(0.77824)(0.98156)$
$= 0.16019$
Since moonrise is sought and $\cos H_2$ is positive, H_2 is in quadrant 4:
$H_2 = 279^\circ.218$
$\tau_2 = (279^\circ.218 - 78^\circ.256)/347^\circ.150 = 0^d.5789$
Again we seek $|\tau_2| < 0^d.5$, so
$\tau_2 = 0^d.5789 - (360^\circ/347^\circ.150) = -0^d.4581$
$t_2 = 13^d.7083 - 0^d.4581 = 13^d.2502 = 13$ January, 0600 UT
Since $|t_2 - t_1| < 0^d.01$, t_2 is accurate to $\pm 5^m$.

Polaris (Pole Star)

The following formulas are relevant to observations of Polaris:

(1) $\phi = a - p\cos h + 0.5p\sin p \sin^2 h \tan\phi$

(2) $A\cos\phi = p\sin h + p\sin p \sin h \cos h \tan\phi$

where: p = polar distance of Polaris = 90° − declination of Polaris
h = LHA of Polaris = LHA Aries + SHA Polaris + east (−west) longitude
ϕ = observer's latitude
A = azimuth of Polaris
a = corrected altitude of Polaris

Eq. (1) permits the observer's latitude to be determined from an observation of the altitude of Polaris (corrected for refraction, dip, *etc.*). Assumed values of the observer's latitude and longitude can be used for the right side of eq. (1). Eq. (2) yields the azimuth of Polaris if the observer's position is known. These expressions are accurate only for Polaris, since they depend on p being a small quantity. The SHA and declination of Polaris to be used in the above formulas should refer to the apparent place of date (see Stellar Tables section; Polaris is star number 17, page E1).

Equation of Position Line

The following formula can be used to obtain a line of position (LOP) directly from an observation of the altitude of a celestial body:

$$\lambda = \text{GHA} \pm \arccos\left[(\sin a - \sin\phi \sin d) / \cos\phi \cos d\right]$$

where: a = corrected altitude of body
GHA = GHA of body for the time of observation
d = declination of body for the time of observation
ϕ = some latitude
λ = computed longitude

North latitudes and west longitudes are positive; south latitudes and east longitudes are negative. Longitudes with absolute values greater than 180° may be encountered. The operation connecting the two terms is + for bodies east of the meridian (rising) and – for bodies west of the meridian (setting).

The above formula yields the longitude λ at which the position line crosses the parallel of latitude ϕ. Repeated application of the above formula, using different latitude values, therefore yields a locus of points all lying on the LOP. Note that no assumed position is necessary, although an estimate of the observer's latitude is helpful in reducing the number of times the formula is applied.

The formula becomes indeterminate at the transit time of a body and for latitudes which the position line does not cross at any point.

Atmospheric Refraction

The Earth's atmosphere tends to refract light in such a way that celestial bodies appear slightly higher in the sky than they would if there were no atmosphere. The formulas below can be used to determine R, the angle of refraction. R should be subtracted from an observed (*e.g.*, sextant) altitude to obtain the corrected altitude.

(1) $$R'' = 524789.399 B\left[z - \arcsin(0.998115 \sin z)\right] / (460 + T)$$

(2) $$R' = \exp(-h/27000) \tan z = 1 / [\exp(h/27000) \tan a]$$

where: T = temperature in degrees Fahrenheit
B = barometric pressure in inches of Mercury
a = observed altitude
z = observed zenith distance = 90° – a
h = height of observer above sea level in feet
R'' = refraction correction in seconds of arc
R' = refraction correction in minutes of arc

Eqs. (1) and (2) are accurate to about 0′.1 and 0′.2, respectively, for altitudes greater than 10°. Eq. (1) is most suitable for surface observations, while eq. (2) is most suitable for observations from aircraft. Both formulas are approximations and are not equivalent to a complete theory of refraction.

Parallax in Altitude

The finite size of the Earth causes a parallactic shift in the apparent positions of nearby celestial objects. The parallax in altitude is computed from

$$\sin PA = \sin\pi \cos a$$

where a is the observed altitude, π is the horizontal parallax, and PA is the parallax in altitude. When the horizontal parallax of a body is not available, it may be calculated from the relation $\pi = 8''.794/d$, where d is the geocentric distance of the body in astronomical units. The parallax in altitude can exceed $1'$ only for the Moon. Since parallax tends to decrease the apparent altitude of a body, the quantity PA should be added to an observed (*e.g.*, sextant) altitude in order to obtain the corrected altitude. To a reasonable approximation, PA can also be calculated from

$$PA = \pi \cos a$$

Dip of Horizon

The dip of the apparent horizon from a horizontal plane is given by

$$D = -0.97\sqrt{h}$$

where h is the height of eye level of the observer in feet and D is the dip of the horizon in minutes of arc. For observations of a celestial body made with a marine sextant or similar instrument, D should be added to the observed altitude to obtain the corrected altitude. The above formula is an approximation; the apparent dip varies with atmospheric conditions.

Correction for Phase of Venus

When the altitude of Venus is observed with a small instrument, a correction to the observed altitude is required to account for the fact that the center of light, rather than the center of the disk, is observed. This correction has the form $-k\cos\theta$, where k is a correction factor (given below) and θ is the angle on the celestial sphere, at the position of Venus, between the observer's vertical and the direction of the Sun. The correction, which should be added to the observed (*e.g.*, sextant) altitude, is positive when the Sun is lower than Venus, zero when they have the same altitude, and negative when the Sun is higher.

In sight reduction, this effect can be approximately taken into account by correcting the GHA (or LHA) of Venus rather than the observed altitude. Simply add k to the GHA (or LHA) of Venus when Venus is east of the Sun (evening star) and subtract k from the GHA (or LHA) of Venus when Venus is west of the Sun (morning star). The correction should not be applied in this way near the time of superior or inferior conjunction.

The values of k for 1977 are:

	k
Jan. 1	0.1
Feb. 7	0.2
Mar. 3	0.3
Mar. 19	0.4
Apr. 24	0.3
May 10	0.2
June 1	0.1
July 21	0.0
Dec. 31	

Venus is at inferior conjunction on April 6. Before April 6 Venus is an evening star, and after April 6 Venus is a morning star.

Motion of Body and Motion of Observer

The following formula gives the change of altitude of a celestial body, due to the rotation of the Earth, in the time interval Δt (*e.g.*, the interval between a sextant observation and the time of a fix). This correction may be applied to the observed altitude to permit the use of a common assumed position and LHA Aries for observations made at different times.

$$MOB = 15.04\,\Delta t \cos\phi \sin A$$

where MOB is the altitude correction in minutes of arc, Δt is the time difference in minutes, ϕ is the latitude of the observer, and A is the azimuth of the observed body. If the time of the fix is later than the time of observation, MOB should be added to the observed altitude.

The following formula gives the change of altitude of a celestial body, due to the movement of the observer, in the time interval Δt (*e.g.*, the interval between a sextant observation and the time of a fix). This correction may be applied to the altitude in lieu of advancing or retiring a line of position.

$$MOO = \frac{v\,\Delta t}{60} \cos(A - C)$$

where MOO is the altitude correction in minutes of arc, Δt is the time difference in minutes, A is the azimuth of the observed body, C is the track/course angle, and v is the ground speed in knots. If the time of the fix is later than the time of observation, MOO should be added to the observed altitude.

Coriolis Correction

Any object moving across or above the surface of the rotating Earth is subject to an apparent force tending to push the object to the right in the northern hemisphere and to the left in the southern hemisphere. This Coriolis acceleration manifests itself as a deflection of the apparent vertical by an amount Z given by

$$(1) \qquad Z = 2.62\,V\sin\phi + 0.146\,V^2\sin C\tan\phi - 5.25\,V\,C'$$

where: Z = deflection in minutes of arc
V = speed of body in hundreds of knots
ϕ = latitude
C = true track/course angle
C' = rate of change of true track/course angle per minute of time

Usually only the first term on the right of eq. (1) is significant.

Observations of the altitudes of celestial bodies made with bubble sextants or similar artificial horizon instruments must be corrected for the Coriolis effect. The correction Δz, which can be added to the observed (*e.g.*, bubble sextant) altitude, is given approximately by

$$(2) \qquad \Delta z = Z\sin(A - C)$$

where: Δz = altitude correction in minutes of arc
Z = deflection of vertical from eq. (1)
A = azimuth of observed body
C = true track/course angle

In the northern hemisphere the correction Δz is positive for stars on the right and negative for stars on the left of the aircraft. In the southern hemisphere the correction is negative for stars on the right and positive for stars on the left.

Section C: ASTRONOMICAL TABLES

CHEBYSHEV APPROXIMATION OF SIDEREAL TIME FOR YEAR 1977

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	APP S T	EQ OF EQ	NUT LON	NUT OBL
	H	S	"	"
0	19.64668607	1.0557	17.2598	-16.2516
1	3.12119465	-0.0791	-1.2930	0.4114
2	-0.00001199	-0.0432	-0.7059	-0.1385
3	0.00000155	0.0056	0.0915	-0.0636
4	-0.00000016	-0.0006	-0.0097	0.0085
5	-0.00000016	-0.0006	-0.0095	0.0127
6	-0.00000066	-0.0024	-0.0389	-0.0028
7	0.00000001	0.0	0.0005	-0.0046
8	-0.00000057	-0.0021	-0.0336	-0.0022
9	0.0	0.0	-0.0001	-0.0217
10	-0.00000063	-0.0023	-0.0373	-0.0024
11	0.00000007	0.0003	0.0042	-0.0251
12	0.00000103	0.0037	0.0605	0.0006
13	-0.00000001	0.0	-0.0008	-0.0030
14	0.00000090	0.0033	0.0532	0.0008
15	-0.00000007	-0.0002	-0.0039	0.0274
16	-0.00000057	-0.0021	-0.0338	-0.0025
17	0.00000011	0.0004	0.0064	0.0066
18	-0.00000097	-0.0035	-0.0571	-0.0009
19	0.00000015	0.0005	0.0087	-0.0337
20	0.00000140	0.0050	0.0821	0.0069
21	-0.00000025	-0.0009	-0.0148	0.0295
22	-0.00000089	-0.0032	-0.0524	-0.0043
23	0.00000005	0.0002	0.0027	-0.0146
24	0.00000035	0.0013	0.0208	-0.0011
25	0.00000008	0.0003	0.0047	0.0050
26	-0.00000011	-0.0004	-0.0064	0.0013
27	0.0	0.0	-0.0001	-0.0015
28	0.00000004	0.0001	0.0021	0.0016
29	-0.00000011	-0.0004	-0.0063	0.0003
30	0.0	0.0	-0.0001	-0.0033
31	0.00000013	0.0005	0.0077	0.0003
32	-0.00000001	0.0	-0.0007	0.0028
33	-0.00000009	-0.0003	-0.0051	-0.0003

CHEBYSHEV APPROXIMATION OF SIDEREAL TIME FOR YEAR 1977

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	APP S T	EQ OF EQ	NUT LON	NUT OBL
	H	S	"	"
0	31.47437619	0.7746	12.6634	-17.3095
1	3.12121407	-0.0092	-0.1500	-0.7509
2	0.00001048	0.0377	0.6167	0.1357
3	-0.00000062	-0.0022	-0.0365	0.0606
4	0.00000019	0.0007	0.0110	0.0067
5	0.00000076	0.0027	0.0448	-0.0074
6	0.00000080	0.0029	0.0473	0.0158
7	0.00000007	0.0003	0.0042	0.0050
8	0.00000064	0.0023	0.0379	0.0131
9	-0.00000123	-0.0044	-0.0722	0.0180
10	0.00000020	0.0007	0.0115	0.0043
11	-0.00000038	-0.0014	-0.0225	0.0222
12	-0.00000078	-0.0028	-0.0459	-0.0153
13	-0.00000022	-0.0008	-0.0131	0.0021
14	-0.00000083	-0.0030	-0.0489	-0.0168
15	0.00000078	0.0028	0.0459	-0.0230
16	0.00000041	0.0015	0.0243	0.0079
17	0.00000029	0.0011	0.0173	-0.0078
18	0.00000084	0.0030	0.0493	0.0168
19	-0.00000087	-0.0031	-0.0514	0.0254
20	-0.00000098	-0.0035	-0.0575	-0.0196
21	0.00000070	0.0025	0.0414	-0.0204
22	0.00000067	0.0024	0.0397	0.0137
23	-0.00000045	-0.0016	-0.0264	0.0131
24	-0.00000039	-0.0014	-0.0231	-0.0078
25	0.00000020	0.0007	0.0117	-0.0061
26	0.00000011	0.0004	0.0067	0.0021
27	0.0	0.0	0.0001	0.0002
28	0.00000007	0.0002	0.0040	0.0014
29	-0.00000009	-0.0003	-0.0053	0.0027
30	-0.00000013	-0.0005	-0.0074	-0.0026
31	0.00000010	0.0004	0.0061	-0.0031
32	0.00000012	0.0004	0.0069	0.0024
33	-0.00000008	-0.0003	-0.0047	0.0023

CHEBYSHEV APPROXIMATION OF SIDEREAL TIME FOR YEAR 1977

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	APP S T	EQ OF EQ	NUT LON	NUT OBL
	H	S	"	"
0	43.43354811	0.7171	11.7247	-17.5239
1	3.12119371	-0.0825	-1.3482	0.4626
2	-0.00001000	-0.0360	-0.5885	-0.1020
3	0.00000008	0.0003	0.0050	-0.0775
4	0.00000081	0.0029	0.0477	-0.0159
5	-0.00000053	-0.0019	-0.0314	0.0019
6	-0.00000015	-0.0005	-0.0087	-0.0240
7	0.00000021	0.0008	0.0124	0.0025
8	-0.00000022	-0.0008	-0.0130	-0.0216
9	0.00000091	0.0033	0.0538	0.0070
10	0.00000032	0.0012	0.0190	-0.0063
11	0.00000091	0.0033	0.0538	0.0033
12	-0.00000036	-0.0013	-0.0214	0.0194
13	0.00000014	0.0005	0.0083	0.0004
14	-0.00000012	-0.0004	-0.0071	0.0221
15	-0.00000107	-0.0038	-0.0628	-0.0048
16	0.00000006	0.0002	0.0033	-0.0140
17	-0.00000021	-0.0008	-0.0126	-0.0028
18	0.00000013	0.0005	0.0078	-0.0229
19	0.00000134	0.0048	0.0792	0.0032
20	-0.00000004	-0.0001	-0.0022	0.0348
21	-0.00000123	-0.0044	-0.0722	-0.0009
22	0.00000005	0.0002	0.0027	-0.0222
23	0.00000059	0.0021	0.0345	0.0025
24	-0.00000012	-0.0004	-0.0072	0.0080
25	-0.00000017	-0.0006	-0.0097	-0.0029
26	0.00000007	0.0003	0.0041	-0.0020
27	0.00000004	0.0002	0.0026	0.0001
28	0.00000006	0.0002	0.0033	0.0010
29	-0.00000004	-0.0001	-0.0021	0.0026
30	-0.00000013	-0.0005	-0.0075	-0.0010
31	0.00000004	0.0001	0.0022	-0.0032
32	0.00000011	0.0004	0.0067	0.0009
33	-0.00000003	-0.0001	-0.0017	0.0022

CHEBYSHEV APPROXIMATION OF SIDEREAL TIME FOR YEAR 1977

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	APP S T	EQ OF EQ	NUT LON	NUT OBL
	H	S	"	"
0	7.52406951	0.4071	6.6557	-18.2874
1	3.12121388	-0.0098	-0.1610	-0.6816
2	0.00001076	0.0387	0.6331	0.1114
3	-0.00000140	-0.0051	-0.0826	0.1066
4	-0.00000173	-0.0062	-0.1015	-0.0031
5	-0.00000026	-0.0010	-0.0155	0.0087
6	-0.00000077	-0.0028	-0.0455	0.0030
7	-0.00000013	-0.0005	-0.0077	-0.0022
8	-0.00000044	-0.0016	-0.0257	0.0017
9	0.00000017	0.0006	0.0097	-0.0204
10	-0.00000066	-0.0024	-0.0387	-0.0018
11	-0.00000022	-0.0008	-0.0129	-0.0222
12	0.00000090	0.0032	0.0530	-0.0006
13	0.00000004	0.0002	0.0025	-0.0030
14	0.00000086	0.0031	0.0507	-0.0022
15	0.00000004	0.0001	0.0021	0.0259
16	-0.00000058	-0.0021	-0.0341	-0.0008
17	0.00000005	0.0002	0.0027	0.0049
18	-0.00000096	-0.0035	-0.0568	0.0011
19	0.00000006	0.0002	0.0038	-0.0338
20	0.00000147	0.0053	0.0865	0.0021
21	-0.00000010	-0.0004	-0.0059	0.0304
22	-0.00000090	-0.0032	-0.0530	-0.0007
23	-0.00000005	-0.0002	-0.0030	-0.0134
24	0.00000029	0.0011	0.0172	-0.0025
25	0.00000010	0.0004	0.0060	0.0033
26	-0.00000007	-0.0003	-0.0044	0.0013
27	0.00000003	0.0001	0.0020	-0.0016
28	0.00000007	0.0003	0.0041	0.0025
29	-0.00000016	-0.0006	-0.0092	0.0021
30	-0.00000009	-0.0003	-0.0052	-0.0039
31	0.00000014	0.0005	0.0085	-0.0022
32	0.00000008	0.0003	0.0049	0.0026
33	-0.00000007	-0.0003	-0.0042	0.0018

CHEBYSHEV APPROXIMATION OF SOLAR COORDINATES FOR YEAR 1977

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	R A	DEC	DISTANCE	S D	EPHEM TR
	H	0	AU	'	H
0	43.9219163	-20.271038	1.98037141	32.35827	24.2755126
1	3.1028593	15.159850	0.00900922	-0.14694	-0.0218778
2	-0.0922395	1.785721	0.00184927	-0.02960	-0.0915166
3	0.0122511	-0.489089	-0.00028085	0.00484	0.0126204
4	0.0042757	-0.000834	-0.00003878	0.00062	0.0041870
5	-0.0008269	0.004860	-0.00000056	0.0	-0.0008301
6	-0.0000012	-0.001308	0.00000210	-0.00004	0.0000045
7	-0.0000245	-0.000167	-0.00000288	0.00005	-0.0000268
8	-0.0000264	0.000034	0.00001877	-0.00032	-0.0000180
9	0.0000689	0.000291	0.00000416	-0.00008	0.0000705
10	0.0000096	0.000014	-0.00001291	0.00020	0.0000050
11	-0.0000301	-0.000136	-0.00000152	0.00003	-0.0000308
12	-0.0000013	-0.000010	0.00000410	-0.00007	-0.0000008
13	0.0000069	0.000039	0.00000060	-0.00001	0.0000069
14	0.0000026	0.000016	-0.00000068	0.0	0.0000014
15	-0.0000009	-0.000008	-0.00000029	0.00001	-0.0000006
16	-0.0000006	0.000003	0.00000007	-0.00001	-0.0000003
17	0.0000008	-0.000005	-0.00000016	0.00002	0.0000003
18	-0.0000020	-0.000014	-0.00000011	0.00001	-0.0000014
19	-0.0000004	0.000006	0.00000033	-0.00001	-0.0000001
20	0.0000027	0.000013	0.00000011	-0.00002	0.0000014
21	0.0	-0.000006	-0.00000023	0.00001	0.0000002
22	-0.0000018	-0.000005	-0.00000004	0.0	-0.0000005
23	0.0	0.000002	0.00000011	0.0	0.0

CHEBYSHEV APPROXIMATION OF SOLAR COORDINATES FOR YEAR 1977

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	R A	DEC	DISTANCE	S D	EPHEM TR
	H	0	AU	'	H
0	7.4937593	33.125671	2.01957490	31.73009	24.0191748
1	3.1310238	9.489837	0.00891633	-0.14035	0.0121669
2	0.0654541	-2.985165	-0.00183059	0.02935	0.0650035
3	-0.0068840	-0.292450	-0.00024114	0.00354	-0.0072743
4	-0.0049532	0.036776	0.00001331	-0.00022	-0.0049475
5	0.0000327	0.005908	0.00000275	-0.00005	0.0000511
6	0.0001579	0.000346	0.00000261	-0.00005	0.0001605
7	-0.0000324	-0.000327	0.00000097	-0.00001	-0.0000321
8	0.0000040	-0.000093	0.00001947	-0.00031	0.0000113
9	0.0000705	0.000138	-0.00000135	0.00001	0.0000713
10	-0.0000028	-0.000030	-0.00001306	0.00021	-0.0000083
11	-0.0000325	-0.000052	0.00000056	0.0	-0.0000316
12	-0.0000004	0.000022	0.00000430	-0.00003	0.0000022
13	0.0000093	0.000021	-0.00000017	0.00002	0.0000091
14	-0.0000010	-0.000019	-0.00000120	0.0	-0.0000007
15	-0.0000012	-0.000006	0.00000003	0.0	-0.0000018
16	0.0000002	0.000004	0.0	0.0	-0.0000002
17	-0.0000008	-0.000004	0.00000005	0.0	-0.0000011
18	0.0000012	0.000007	0.00000046	-0.00001	0.0000004
19	0.0000008	0.000006	-0.00000005	0.00001	0.0000015
20	-0.0000013	-0.000009	-0.00000042	0.00001	-0.0000005
21	-0.0000003	-0.000003	0.00000004	0.0	-0.0000012
22	0.0000009	0.000005	0.00000023	-0.00001	0.0000005
23	0.0000001	0.000003	-0.00000002	0.00001	0.0000005

CHEBYSHEV APPROXIMATION OF SOLAR COORDINATES FOR YEAR 1977

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	R A	DEC	DISTANCE	S D	EPHEM TR
	H	0	AU	'	H
0	19.4312573	22.803286	2.02068811	31.71247	23.9955523
1	2.9875630	-14.050201	-0.00841376	0.13228	-0.1360105
2	-0.0646479	-1.956729	-0.00192699	0.03074	-0.0639638
3	0.0110622	0.378466	0.00023080	-0.00337	0.0113767
4	0.0037316	0.010945	0.00001690	-0.00027	0.0036753
5	-0.0005061	-0.002453	0.00000773	-0.00013	-0.0005053
6	-0.0000131	0.000838	0.00000181	-0.00004	-0.0000102
7	-0.0000237	0.000064	0.00000724	-0.00012	-0.0000219
8	0.0000396	-0.000262	0.00001524	-0.00023	0.0000454
9	0.0000577	-0.000188	-0.00001094	0.00016	0.0000522
10	-0.0000296	0.000128	-0.00001096	0.00016	-0.0000341
11	-0.0000246	0.000097	0.00000469	-0.00007	-0.0000236
12	0.0000098	-0.000033	0.00000353	-0.00003	0.0000109
13	0.0000060	-0.000030	-0.00000136	0.00001	0.0000049
14	-0.0000029	0.000014	-0.00000044	0.00002	-0.0000029
15	-0.0000013	0.000009	0.00000030	-0.00002	0.0
16	0.0	-0.000001	0.00000005	0.0	0.0000003
17	0.0000003	0.000002	0.00000013	0.0	0.0000006
18	0.0000008	-0.000005	-0.00000024	-0.00001	0.0000005
19	0.0000005	-0.000005	-0.00000023	0.0	-0.0000010
20	-0.0000006	0.000007	0.00000024	0.0	-0.0000007
21	-0.0000005	0.000003	0.00000017	0.0	0.0000004
22	0.0000005	-0.000005	-0.00000013	-0.00001	0.0000002
23	0.0	-0.000002	-0.00000008	0.0	-0.0000006

CHEBYSHEV APPROXIMATION OF SOLAR COORDINATES FOR YEAR 1977

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	R A	DEC	DISTANCE	S D	EPHEM TR
	H	0	AU	'	H
0	31.2416685	-31.868567	1.98084443	32.35058	23.7198641
1	3.2534344	-10.261123	-0.00919721	0.14994	0.1359482
2	0.1018921	3.054129	0.00181971	-0.02909	0.1013457
3	-0.0085834	0.410943	0.00028964	-0.00500	-0.0090957
4	-0.0067006	-0.036188	-0.00002838	0.00043	-0.0067162
5	-0.0001688	-0.010980	0.00001125	-0.00017	-0.0001376
6	0.0002318	-0.000662	0.00000062	-0.00001	0.0002386
7	0.0000309	0.000485	0.00001202	-0.00019	0.0000355
8	0.0000717	-0.000092	0.00000418	-0.00007	0.0000729
9	0.0000136	-0.000059	-0.00001784	0.00028	0.0000053
10	-0.0000545	0.000124	-0.00000252	0.00004	-0.0000548
11	-0.0000078	-0.000013	0.00000803	-0.00013	-0.0000040
12	0.0000176	-0.000041	0.00000087	-0.00001	0.0000171
13	0.0000032	0.000014	-0.00000166	0.00003	0.0000027
14	-0.0000012	0.000003	-0.00000039	0.0	-0.0000026
15	-0.0000009	-0.000005	0.00000015	0.00001	-0.0000011
16	-0.0000001	-0.000007	-0.00000005	0.0	0.0000004
17	-0.0000011	-0.000004	-0.00000026	0.0	-0.0000013
18	-0.0000023	0.000009	0.00000034	-0.00001	-0.0000009
19	0.0000014	0.000006	0.00000032	0.0	0.0000015
20	0.0000030	-0.000012	-0.00000027	0.00002	0.0000014
21	-0.0000011	-0.000003	-0.00000023	-0.00001	-0.0000010
22	-0.0000017	0.000004	0.00000010	-0.00001	-0.0000005
23	0.0000004	0.000004	0.00000010	0.0	0.0000005

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 1 THRU 32 JD 2443144.5 TO 2443176.5 DATES JAN 1 THRU FEB 1

A = 16.00000000 B = -1.06250000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	O	'			
0	34.54852297	16.3602482	112.1887786	13.1865350	50.5311676	18.0077768
1	14.11362413	-0.0959643	-0.0120838	7.7470285	-1.2379915	-0.1853765
2	-0.13803750	16.0772528	-2.0643927	9.4680666	47.4300834	16.8413747
3	-0.21435768	0.7621011	0.9553940	-47.7800723	8.3861136	0.7466928
4	0.05718718	-8.8947812	1.2262848	-4.8966771	-26.0554287	-9.1743308
5	0.13897407	0.0836728	-0.0096420	12.3959340	-1.8470973	-0.0673403
6	0.01639417	1.7805425	-0.3045272	0.4721184	4.5731948	1.5894183
7	-0.07388441	-0.1466800	-0.1033447	-1.8517475	0.0576524	-0.0652858
8	-0.00726184	-0.4169052	0.0838687	0.0248370	-0.7006400	-0.2393175
9	0.02612589	0.0097224	0.0375264	0.3132980	0.0042263	0.0156681
10	0.00051108	0.1428469	-0.0256705	0.0064023	0.1297896	0.0448519
11	-0.00830251	0.0135025	-0.0110619	-0.0613901	0.0104837	0.0008396
12	-0.00012428	-0.0525057	0.0071415	-0.0084967	-0.0265267	-0.0094952
13	0.00304154	-0.0056598	0.0033322	0.0132849	-0.0055577	-0.0013129
14	0.00021641	0.0186503	-0.0017568	0.0034174	0.0060501	0.0022339
15	-0.00123001	0.0017773	-0.0010376	-0.0031693	0.0018869	0.0005061
16	-0.00010966	-0.0065540	0.0004051	-0.0010753	-0.0014679	-0.0005533
17	0.00049694	-0.0007200	0.0003321	0.0007696	-0.0005639	-0.0001592
18	0.00003960	0.0023703	-0.0000908	0.0003147	0.0003510	0.0001348
19	-0.00019751	0.0003200	-0.0001057	-0.0001808	0.0001624	0.0000477
20	-0.00001639	-0.0008889	0.0000193	-0.0000908	-0.0000806	-0.0000317
21	0.00007913	-0.0001316	0.0000329	0.0000408	-0.0000469	-0.0000144
22	0.00000784	0.0003397	-0.0000033	0.0000264	0.0000178	0.0000073
23	-0.00003233	0.0000522	-0.0000099	-0.0000087	0.0000136	0.0000042
24	-0.00000364	-0.0001309	0.0000002	-0.0000077	-0.0000037	-0.0000015
25	0.00001339	-0.0000209	0.0000029	0.0000018	-0.0000040	-0.0000012
26	0.00000160	0.0000509	0.0000002	0.0000022	0.0000007	0.0000003
27	-0.00000555	0.0000085	-0.0000008	-0.0000003	0.0000012	0.0000005
28	-0.00000070	-0.0000200	-0.0000001	-0.0000006	-0.0000001	-0.0000001
29	0.00000230	-0.0000036	0.0000002	0.0	-0.0000004	-0.0000001
30	0.00000032	0.0000080	0.0000001	0.0000003	0.0	0.0
31	-0.00000096	0.0000015	-0.0000001	-0.0000001	0.0000002	0.0
32	-0.00000015	-0.0000036	-0.0000001	0.0	0.0	0.0000001
33	0.00000041	-0.0000006	0.0	0.0	-0.0000001	0.0
34	0.00000007	0.0000014	0.0	0.0	0.0	0.0
35	-0.00000018	0.0000005	0.0	0.0	-0.0000001	-0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 32 THRU 63 JD 2443175.5 TO 2443207.5 DATES FEB 1 THRU MAR 4

A = 16.00000000 B = -3.00000000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	40.93751191	12.1695606	113.7666006	-23.8280729	41.8402348	13.2930105
1	14.04393036	1.8260512	-0.2122194	6.1231016	4.8584759	1.8466729
2	-0.23768648	11.7145342	-0.2754504	-31.3910185	39.0396551	12.1070581
3	-0.04549656	-10.7145582	2.1172858	-38.6277734	-28.3011328	-11.2388797
4	0.16209442	-6.0161453	0.3915857	17.3788429	-20.7388973	-6.3376209
5	0.03379758	3.0175259	-0.3326313	8.7653846	7.5345933	2.9358955
6	-0.08311069	0.5342972	-0.1754175	-3.2745987	2.5374744	0.7229843
7	-0.00902055	-0.6309754	-0.0296852	-0.5579147	-1.2622588	-0.4541696
8	0.03262760	0.0810575	0.0569017	0.5508526	-0.0517799	0.0058591
9	-0.00276772	0.1623138	0.0028284	-0.0211859	0.2126565	0.0715530
10	-0.00828362	-0.0391446	-0.0178766	-0.0863575	-0.0097221	-0.0069512
11	0.00332857	-0.0429252	0.0036415	0.0016417	-0.0301950	-0.0101956
12	0.00169425	0.0163796	0.0045617	0.0119600	-0.0014393	0.0000101
13	-0.00170684	0.0097247	-0.0013690	0.0014446	0.0048025	0.0016944
14	-0.00025170	-0.0071233	-0.0008577	-0.0025386	0.0008848	0.0001961
15	0.00067905	-0.0012988	0.0003166	-0.0004502	-0.0013025	-0.0004626
16	-0.00005481	0.0026756	0.0001635	0.0007490	-0.0001891	-0.0000332
17	-0.00022806	-0.0002554	-0.0000643	0.0000640	0.0003666	0.0001274
18	0.00007796	-0.0008461	-0.0000460	-0.0001908	0.0000150	-0.0000028
19	0.00006322	0.0002985	0.0000150	0.0000023	-0.0000849	-0.0000287
20	-0.00004589	0.0002155	0.0000140	0.0000411	0.0000039	0.0000030
21	-0.00001222	-0.0001588	-0.0000050	-0.0000032	0.0000176	0.0000060
22	0.00002034	-0.0000345	-0.0000037	-0.0000086	-0.0000016	-0.0000009
23	-0.00000040	0.0000660	0.0000018	0.0000007	-0.0000037	-0.0000013
24	-0.00000755	-0.0000049	0.0000007	0.0000020	0.0000003	0.0000002
25	0.00000204	-0.0000228	-0.0000005	-0.0000002	0.0000010	0.0000003
26	0.00000235	0.0000078	-0.0000001	-0.0000005	-0.0000001	-0.0000001
27	-0.00000138	0.0000062	0.0000001	0.0	-0.0000003	-0.0000001
28	-0.00000055	-0.0000043	0.0000001	0.0000001	0.0	0.0
29	0.00000066	-0.0000012	-0.0000001	0.0	0.0	0.0
30	0.00000004	0.0000021	0.0	0.0	-0.0000001	0.0
31	-0.00000027	-0.0000002	-0.0000001	0.0000001	0.0	0.0
32	0.00000003	-0.0000008	0.0000001	0.0	0.0000001	-0.0000001
33	0.00000008	0.0000001	0.0	0.0	0.0	0.0
34	-0.00000005	0.0	0.0	0.0000001	0.0	0.0
35	-0.00000004	0.0000001	0.0	0.0	0.0000001	0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 60 THRU 91 JD 2443203.5 TO 2443235.5 DATES MAR 1 THRU APR 1

A = 16.00000000 B = -4.75000000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	42.08472430	10.6304326	114.0161207	-28.1886740	37.9287688	11.7007540
1	14.01088564	2.1119653	-0.4206887	5.0384585	6.0143667	2.1745877
2	-0.30267661	9.9214765	0.0957720	-37.5024167	34.5730456	10.2347301
3	-0.00284601	-12.1338415	2.4244545	-33.3429658	-33.6955871	-12.7126803
4	0.17287249	-4.8950584	0.0442509	20.5632330	-17.9408966	-5.2350225
5	-0.01722647	3.2944613	-0.2507843	7.0923836	8.7371985	3.2398678
6	-0.06969677	0.1768617	0.0370511	-3.5975767	1.7762756	0.4528177
7	0.02002570	-0.5513360	-0.1162694	-0.1450862	-1.2645172	-0.4336847
8	0.02333788	0.1940075	0.0021915	0.4706232	0.1379399	0.0659124
9	-0.01034568	0.0682770	0.0350074	-0.1112041	0.1415943	0.0433602
10	-0.00343016	-0.0655851	-0.0135304	-0.0328021	-0.0443782	-0.0163633
11	0.00403036	0.0037050	-0.0039474	0.0132008	0.0001739	0.0006094
12	-0.00059830	0.0158843	0.0048056	-0.0052708	0.0006889	0.0000249
13	-0.00122253	-0.0057082	-0.0004836	0.0023361	-0.0030900	-0.0009534
14	0.00062974	-0.0028167	-0.0005983	0.0011088	0.0020267	0.0007305
15	0.00025059	0.0025696	0.0002902	-0.0013331	0.0000862	-0.0000243
16	-0.00028981	0.0000833	-0.0000681	0.0002201	-0.0006308	-0.0002049
17	0.00000243	-0.0009081	-0.0000180	0.0002687	0.0001950	0.0000767
18	0.00009773	0.0002363	0.0000391	-0.0001291	0.0000798	0.0000220
19	-0.00003411	0.0002504	-0.0000207	-0.0000122	-0.0000592	-0.0000206
20	-0.00002330	-0.0001536	-0.0000036	0.0000243	0.0000055	0.0000029
21	0.00002040	-0.0000406	0.0000080	-0.0000068	0.0000064	0.0000020
22	0.00000176	0.0000659	-0.0000020	-0.0000004	-0.0000035	-0.0000012
23	-0.00000801	-0.0000068	-0.0000011	0.0000012	0.0000010	0.0000003
24	0.00000197	-0.0000212	0.0000008	-0.0000009	0.0000002	0.0
25	0.00000225	0.0000091	-0.0000001	0.0000003	-0.0000005	-0.0000002
26	-0.00000146	0.0000045	0.0	0.0000001	0.0000002	0.0000002
27	-0.00000034	-0.0000049	0.0	-0.0000001	-0.0000001	0.0
28	0.00000066	0.0000003	-0.0000001	0.0000001	0.0	-0.0000001
29	-0.00000009	0.0000020	0.0	0.0	0.0000001	0.0
30	-0.00000022	-0.0000008	0.0	0.0	0.0000001	0.0
31	0.00000011	-0.0000004	0.0	0.0	0.0	0.0
32	0.00000005	0.0000003	0.0000001	0.0000001	0.0	0.0
33	-0.00000007	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0000001	-0.0000001	0.0	0.0	0.0
35	0.00000002	-0.0000001	0.0	0.0000001	0.0	-0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 91 THRU 122 JD 2443234.5 TO 2443266.5 DATES APR 1 THRU MAY 2

A = 16.00000000 B = -6.68750000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	48.52304324	-0.9849396	116.0812735	-41.3989939	4.3874705	-0.1500236
1	13.94424223	2.3044918	-0.3120290	-1.3451751	7.6410327	2.5184257
2	-0.31490727	-3.1611825	2.3627993	-52.2066499	-3.6941856	-3.3064915
3	0.21898770	-15.1979888	2.0940418	4.8421670	-47.0633477	-15.6546612
4	0.12010523	1.9850691	-0.8773563	27.3147114	2.5372475	1.9318647
5	-0.09814346	2.9015165	-0.1012374	-2.0256290	10.1635088	3.3381198
6	0.03855601	-0.7298814	-0.0617986	-2.8570266	-1.1379530	-0.4960454
7	0.04160466	0.1374471	-0.1542520	0.6949692	-0.3609805	-0.0932899
8	-0.02371761	0.1124267	0.0604922	-0.1199622	0.2954570	0.0947381
9	-0.00470024	-0.1049642	0.0151939	-0.0966881	-0.0946628	-0.0357235
10	0.00515309	0.0477236	-0.0134298	0.0359335	-0.0087117	-0.0015015
11	-0.00231016	0.0103012	0.0073585	-0.0125778	0.0038413	0.0007926
12	0.00031016	-0.0232015	0.0005866	0.0045588	-0.0096007	-0.0030531
13	0.00087862	0.0056107	-0.0013579	0.0041992	0.0040342	0.0015233
14	-0.00072081	0.0023568	0.0005923	-0.0024234	0.0007330	0.0001497
15	0.00000288	-0.0027644	-0.0002566	0.0003956	-0.0009682	-0.0003098
16	0.00023428	0.0011500	-0.0000852	0.0002963	0.0004263	0.0001564
17	-0.00010402	0.0002717	0.0001050	-0.0002477	0.0000215	-0.0000028
18	-0.00000426	-0.0005519	-0.0000412	0.0000455	-0.0000820	-0.0000266
19	0.00003486	0.0002013	-0.0000009	0.0000113	0.0000354	0.0000124
20	-0.00002404	0.0000704	0.0000130	-0.0000175	-0.0000087	-0.0000034
21	0.00000146	-0.0000943	-0.0000060	0.0000093	-0.0000042	-0.0000011
22	0.00000873	0.0000319	0.0000008	-0.0000009	0.0000045	0.0000015
23	-0.00000516	0.0000103	0.0000012	-0.0000017	-0.0000017	-0.0000006
24	-0.00000017	-0.0000180	-0.0000008	0.0000012	-0.0000004	-0.0000001
25	0.00000172	0.0000071	0.0000002	-0.0000001	0.0000006	0.0000001
26	-0.00000097	0.0000023	0.0	-0.0000002	0.0	0.0
27	0.00000001	-0.0000036	0.0	0.0	-0.0000001	0.0000001
28	0.00000035	0.0000014	0.0000002	0.0	-0.0000001	0.0000001
29	-0.00000021	0.0000003	0.0	0.0	0.0000001	0.0
30	0.00000003	-0.0000008	-0.0000001	0.0	0.0	0.0
31	0.00000006	0.0000001	0.0	0.0	0.0000001	0.0000001
32	-0.00000006	0.0	-0.0000001	0.0	0.0	-0.0000001
33	-0.00000002	0.0	0.0000001	0.0	0.0	0.0
34	0.0	0.0000001	0.0000001	0.0	0.0	0.0
35	-0.00000001	0.0000002	0.0000001	0.0000001	0.0	-0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 121 THRU 152 JD 2443264.5 TO 2443296.5 DATES MAY 1 THRU JUNE 1

A = 16.00000000 B = -8.56250000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	53.32507299	-9.0350540	117.0673900	-31.1802592	-20.1958356	-7.9913003
1	13.94978768	1.4315380	-0.2044827	-5.6053398	5.5522434	1.6789717
2	-0.20903791	-12.2311607	3.4202553	-39.8939065	-32.1155705	-12.4147289
3	0.38519866	-10.7263723	1.0825365	32.9811939	-36.1387011	-10.9397194
4	0.04114763	6.2471065	-1.2969478	20.5102401	16.9777206	6.4979854
5	-0.04141586	1.6281800	0.0397528	-7.2749566	7.2207194	2.1530316
6	0.08990903	-0.4996259	-0.1649404	-1.5911474	-1.9214783	-0.7037797
7	-0.01987041	0.2760798	-0.1170006	0.3440237	0.0877872	0.0438101
8	-0.03023456	-0.1188250	0.0902985	-0.2561765	-0.0332410	-0.0213322
9	0.00757270	0.0151093	0.0035958	0.0571629	-0.1070728	-0.0338911
10	-0.00034391	0.0371784	-0.0025398	0.0142752	0.0241758	0.0086549
11	-0.00014874	-0.0495192	0.0068657	-0.0061034	-0.0139799	-0.0049697
12	0.00095107	0.0016179	-0.0028856	0.0131072	0.0006526	0.0007251
13	-0.00108763	0.0077280	-0.0001565	-0.0019400	0.0056395	0.0018241
14	0.00031844	-0.0031154	0.0001750	-0.0014245	-0.0012451	-0.0004719
15	0.00035008	0.0017870	-0.0004709	0.0006078	0.0001580	0.0000790
16	-0.00019566	-0.0002787	0.0001510	-0.0003691	0.0001671	0.0000410
17	0.00001852	-0.0005417	0.0000332	0.0000051	-0.0001861	-0.0000635
18	0.00000650	0.0005713	-0.0000296	0.0000506	0.0000404	0.0000159
19	-0.00001910	-0.0001153	0.0000244	-0.0000305	-0.0000075	-0.0000032
20	0.00002083	-0.0000982	-0.0000045	0.0000167	-0.0000120	-0.0000036
21	-0.00000667	0.0000634	-0.0000020	0.0000016	0.0000093	0.0000029
22	-0.00000536	-0.0000290	0.0000019	-0.0000032	-0.0000017	-0.0000007
23	0.00000462	0.0000069	-0.0000018	0.0000020	0.0	0.0000001
24	-0.00000092	0.0000092	0.0000002	-0.0000007	0.0000010	0.0000004
25	-0.00000019	-0.0000096	0.0000003	-0.0000005	-0.0000006	-0.0000002
26	0.00000046	0.0000028	-0.0000001	0.0000003	-0.0000002	0.0000001
27	-0.00000046	0.0000013	0.0	0.0000001	0.0000002	-0.0000001
28	0.00000014	-0.0000014	0.0000001	-0.0000001	0.0000001	0.0
29	0.00000008	0.0000006	0.0	0.0	0.0	-0.0000001
30	-0.00000011	-0.0000001	0.0	0.0	-0.0000001	-0.0000001
31	0.00000005	-0.0000002	0.0	0.0	0.0	0.0
32	0.00000001	0.0000002	-0.0000001	0.0	0.0000001	0.0
33	-0.00000003	0.0	-0.0000002	0.0000001	0.0	0.0000001
34	0.00000001	-0.0000001	0.0000002	0.0	-0.0000001	0.0
35	0.00000002	0.0000002	0.0	0.0	0.0000001	0.0000002

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 152 THRU 183 JD 2443295.5 TO 2443327.5 DATES JUNE 1 THRU JULY 2

A = 16.00000000 B = -10.50000000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	°	'			
0	60.14405648	-13.0774116	117.0492818	3.9000322	-35.9800298	-12.0267225
1	13.97981250	-0.1445307	0.0899043	-8.0273343	0.2279446	-0.2192941
2	0.15393898	-16.6728087	3.3814213	0.3110123	-49.8189109	-16.9421554
3	0.42382106	1.8378019	-1.0175827	50.1332131	-0.3419864	1.6214079
4	-0.06390577	8.3283341	-1.2524440	0.1012093	25.9727319	8.7692614
5	0.02887638	-0.0138711	0.0723079	-10.4904609	0.5055173	-0.1909276
6	-0.02092132	-0.3780094	-0.1884697	-0.4480180	-2.4361456	-0.8303873
7	-0.06806553	-0.2097192	0.0679713	0.1772302	-0.2997531	-0.0953258
8	0.00542003	-0.1082815	0.0897184	0.1547778	-0.1930759	-0.0605546
9	0.01094081	-0.0002983	-0.0016128	0.1130325	0.0464766	0.0195190
10	0.00248897	-0.0556840	-0.0001463	-0.0046818	0.0223694	0.0073067
11	0.00054225	0.0173324	-0.0053694	0.0082907	0.0059317	0.0023122
12	-0.00033373	0.0234800	-0.0027704	-0.0047533	0.0097884	0.0031543
13	0.00054661	0.0012337	0.0003311	-0.0052893	-0.0014599	-0.0006725
14	-0.00030564	-0.0011137	-0.0000944	-0.0000666	-0.0015391	-0.0005192
15	-0.00040990	-0.0015776	0.0002927	0.0001304	-0.0004170	-0.0001383
16	0.00002023	-0.0001294	0.0001582	0.0003005	-0.0001778	-0.0000501
17	0.00006507	-0.0001622	-0.0000165	0.0001295	0.0001067	0.0000409
18	0.00003126	-0.0003216	-0.0000092	-0.0000142	0.0000410	0.0000133
19	-0.00000295	0.0001240	-0.0000181	-0.0000018	0.0000136	0.0000044
20	0.00000066	0.0001203	-0.0000057	-0.0000119	0.0000078	0.0000023
21	0.00000623	0.0000233	0.0000012	-0.0000059	-0.0000042	-0.0000015
22	-0.00000347	-0.0000106	0.0000008	-0.0000001	-0.0000024	-0.0000008
23	-0.00000342	-0.0000102	0.0000012	0.0000006	-0.0000014	-0.0000005
24	-0.00000020	0.0000013	0.0000001	0.0000011	0.0	-0.0000001
25	0.00000067	-0.0000022	-0.0000002	0.0000002	0.0000007	0.0000002
26	0.00000033	-0.0000023	-0.0000001	-0.0000004	0.0	0.0
27	-0.00000010	0.0000007	0.0	0.0	-0.0000003	0.0
28	0.00000005	0.0000011	0.0000001	0.0000001	0.0000001	0.0
29	0.00000008	0.0000004	0.0	0.0	0.0000001	0.0000001
30	-0.00000004	-0.0000001	0.0000001	-0.0000001	0.0	0.0000001
31	-0.00000005	-0.0000002	0.0	0.0000001	0.0000001	-0.0000001
32	-0.00000002	0.0	-0.0000001	0.0	0.0000001	0.0
33	0.0	0.0	0.0	0.0	-0.0000001	0.0
34	0.00000002	0.0	0.0000001	0.0000001	-0.0000001	0.0
35	0.00000001	0.0000001	0.0000001	0.0	0.0	0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 182 THRU 213 JD 2443325.5 TO 2443357.5 DATES JULY 1 THRU AUG 1

A = 16.00000000 B = -12.37500000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	°	'			
0	65.04034207	-9.1205206	115.9872096	30.4500528	-27.8281817	-8.4625359
1	13.98267758	-1.4056041	0.2025894	-6.6922883	-4.1130295	-1.6317650
2	0.32948979	-12.2377723	2.2031722	30.8684110	-40.2186357	-12.7423671
3	0.23897766	10.4269701	-2.0177661	40.3721047	27.3262521	10.4465962
4	-0.11762138	6.4400975	-0.7766397	-15.8279427	21.5002216	6.7558251
5	-0.01948364	-1.6104353	0.2075779	-9.3949070	-5.2980982	-2.0657976
6	-0.07621022	-0.9092526	-0.0991844	1.0474583	-2.8619954	-0.9250039
7	-0.01770155	-0.2911380	0.0997745	0.7838065	-0.2238203	-0.0527962
8	0.03202008	0.0296713	0.0599768	0.3002821	0.1435957	0.0567469
9	0.01033338	0.0200666	-0.0079661	-0.0160770	0.1364948	0.0454074
10	-0.00190841	0.0272210	-0.0094078	-0.0385985	0.0047454	0.0004175
11	-0.00245058	0.0405536	-0.0067628	-0.0033762	0.0001897	0.0000092
12	-0.00070402	-0.0012430	0.0002439	-0.0065618	-0.0003916	-0.0003222
13	-0.00049491	-0.0118419	0.0012147	-0.0009224	-0.0038190	-0.0013141
14	-0.00017459	-0.0043652	0.0002801	0.0013753	-0.0010611	-0.0003166
15	0.00036954	0.0004490	0.0001506	0.0007734	0.0001285	0.0000648
16	0.00023023	0.0009447	-0.0000254	0.0001716	0.0003716	0.0001301
17	-0.00002573	0.0004461	-0.0000510	-0.0001452	0.0001434	0.0000443
18	-0.00006794	0.0003135	-0.0000258	-0.0000743	-0.0000271	-0.0000111
19	-0.00002217	-0.0000016	-0.0000059	-0.0000063	-0.0000236	-0.0000081
20	-0.00000193	-0.0001634	0.0000069	0.0000039	-0.0000091	-0.0000029
21	0.00000094	-0.0000793	0.0000041	0.0000047	-0.0000020	-0.0000005
22	0.00000561	0.0000095	0.0000006	0.0000022	0.0000011	0.0000004
23	0.00000438	0.0000232	-0.0000005	0.0000005	0.0000013	0.0000004
24	-0.00000018	0.0000095	-0.0000004	-0.0000006	0.0000005	0.0000001
25	-0.00000169	0.0000025	0.0	-0.0000003	-0.0000003	-0.0000001
26	-0.00000071	-0.0000009	0.0	0.0000001	-0.0000001	-0.0000001
27	0.00000005	-0.0000029	0.0	0.0	0.0000001	0.0
28	0.00000014	-0.0000014	0.0	-0.0000001	0.0	0.0
29	0.00000011	0.0	-0.0000001	0.0	0.0	0.0
30	0.00000009	0.0000008	-0.0000001	0.0	0.0	0.0
31	-0.00000002	0.0000002	-0.0000001	0.0000001	0.0	0.0
32	-0.00000004	-0.0000001	0.0000002	0.0	0.0	0.0
33	0.0	-0.0000001	-0.0000001	0.0	0.0	-0.0000001
34	-0.00000001	0.0000001	-0.0000001	-0.0000001	0.0	0.0000001
35	0.0	0.0	0.0	0.0000001	-0.0000001	-0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 213 THRU 244 JD 2443356.5 TO 2443388.5 DATES AUG 1 THRU SEPT 1

A = 16.00000000 B = -14.31250000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	O	'			
0	71.50423077	1.9775518	113.9066158	49.0686251	3.8131086	2.5916926
1	14.01521151	-2.5247566	0.3118453	-1.2521994	-7.4854381	-2.6098194
2	0.31922660	0.1296972	-0.0862313	51.5885964	-4.4947067	-0.1970082
3	-0.07370730	14.9657517	-2.2909848	4.8128734	46.3179614	15.6423327
4	-0.15103745	0.2799356	0.2021798	-27.6381905	3.0696429	0.2775065
5	-0.04723635	-3.6399463	0.2940718	-2.1812260	-11.0038384	-3.7317668
6	0.00408299	-0.6430613	-0.0527722	3.8678294	-1.3782710	-0.3533019
7	0.05073295	0.3769575	0.0768235	0.8723816	1.0259004	0.3648393
8	0.01034540	0.2404328	0.0234230	-0.2617885	0.4282222	0.1357500
9	-0.01529367	0.0208376	-0.0213200	-0.1934366	-0.0496625	-0.0217496
10	-0.00620175	-0.0238822	-0.0142375	0.0080948	-0.0638840	-0.0210751
11	0.00173426	-0.0301516	0.0011526	0.0175182	0.0003914	0.0006209
12	0.00198246	-0.0102431	0.0043503	-0.0005047	0.0022067	0.0007157
13	0.00064216	0.0082212	0.0005745	0.0007001	-0.0010495	-0.0003356
14	-0.00020431	0.0063163	-0.0006529	0.0011687	0.0005836	0.0002259
15	-0.00045485	-0.0002074	-0.0001948	-0.0002141	0.0008409	0.0002759
16	-0.00014470	-0.0018407	0.0000355	-0.0005378	0.0000089	-0.0000111
17	0.00012764	-0.0007271	0.0000116	-0.0000657	-0.0002617	-0.0000895
18	0.00009898	0.0001893	-0.0000021	0.0001222	-0.0000577	-0.0000162
19	-0.00000412	0.0003421	0.0000099	0.0000378	0.0000440	0.0000158
20	-0.00003143	0.0001082	0.0000047	-0.0000151	0.0000188	0.0000060
21	-0.00001355	-0.0000754	-0.0000034	-0.0000087	-0.0000038	-0.0000016
22	0.00000303	-0.0000710	-0.0000025	0.0000008	-0.0000031	-0.0000011
23	0.00000684	-0.0000042	0.0000004	0.0000009	0.0000002	0.0
24	0.00000253	0.0000212	0.0000007	0.0	0.0000002	0.0
25	-0.00000148	0.0000107	0.0000001	-0.0000001	-0.0000001	0.0
26	-0.00000165	-0.0000014	-0.0000002	0.0000001	-0.0000002	0.0000001
27	-0.00000018	-0.0000044	-0.0000001	0.0000001	0.0	0.0
28	0.00000049	-0.0000015	0.0000002	-0.0000001	0.0000001	0.0
29	0.00000029	0.0000011	0.0	-0.0000001	-0.0000001	0.0
30	-0.00000001	0.0000012	0.0	0.0	0.0	0.0
31	-0.00000011	0.0000001	0.0	0.0	0.0	0.0000001
32	-0.00000007	0.0	0.0	0.0000001	-0.0000001	0.0
33	0.00000003	-0.0000003	0.0000001	0.0	0.0	0.0
34	0.00000002	0.0000001	0.0	0.0000001	0.0000001	0.0
35	-0.00000001	0.0000001	0.0000001	0.0	0.0	-0.0000001

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 244 THRU 275 JD 2443387.5 TO 2443419.5 DATES SEPT 1 THRU OCT 2

A = 16.00000000 B = -16.25000000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	O				
0	29.77994288	12.1880250	112.2610726	36.9131001	37.9283136	13.5351130
1	14.08309988	-1.7740800	0.1011785	5.1781555	-5.6813912	-1.8007728
2	0.10334686	11.5123275	-1.9249422	37.4234571	33.3437503	11.9963208
3	-0.23647505	9.8306822	-1.1309108	-32.6695872	34.1391878	10.5205404
4	-0.07999236	-6.2709961	1.0473095	-20.6450301	-17.9111600	-6.4717635
5	0.06367753	-2.8835425	0.0632398	8.0431891	-9.0501338	-2.7962131
6	0.06084095	1.0635237	-0.1544530	3.8153539	2.7030218	0.9943505
7	-0.01020865	0.6423882	0.0935514	-0.9150403	1.4526674	0.4580399
8	-0.02934081	-0.1424345	0.0250809	-0.6126985	-0.2792599	-0.1082350
9	0.00047979	-0.1570596	-0.0379218	0.1093546	-0.2334481	-0.0746309
10	0.00947247	0.0132173	-0.0090149	0.0929003	0.0444190	0.0171165
11	0.00109300	0.0396722	0.0112247	-0.0233054	0.0312492	0.0097728
12	-0.00263940	0.0036237	0.0027409	-0.0105832	-0.0115989	-0.0041224
13	-0.00088002	-0.0103592	-0.0028644	0.0067058	-0.0030144	-0.0008301
14	0.00067984	-0.0030863	-0.0005680	0.0008150	0.0034916	0.0011802
15	0.00047455	0.0025096	0.0006726	-0.0019997	0.0001706	0.0000060
16	-0.00014614	0.0015052	0.0000593	-0.0000045	-0.0010050	-0.0003337
17	-0.00020762	-0.0004625	-0.0001637	0.0005438	0.0000184	0.0000200
18	0.00001418	-0.0006254	0.0000140	-0.0000214	0.0002572	0.0000847
19	0.00007869	0.0000097	0.0000428	-0.0001310	-0.0000138	-0.0000080
20	0.00000985	0.0002322	-0.0000108	0.0000105	-0.0000588	-0.0000193
21	-0.00002658	0.0000489	-0.0000116	0.0000287	0.0000064	0.0000029
22	-0.00000901	-0.0000764	0.0000044	-0.0000047	0.0000124	0.0000040
23	0.00000791	-0.0000335	0.0000029	-0.0000059	-0.0000028	-0.0000011
24	0.00000500	0.0000217	-0.0000015	0.0000019	-0.0000025	-0.0000009
25	-0.00000191	0.0000165	-0.0000006	0.0000012	0.0000011	0.0000004
26	-0.00000229	-0.0000048	0.0000004	-0.0000006	0.0000005	0.0000002
27	0.00000026	-0.0000068	0.0000001	-0.0000004	-0.0000004	-0.0000002
28	0.00000092	0.0000004	-0.0000002	0.0000003	-0.0000001	0.0
29	0.00000009	0.0000027	-0.0000001	0.0000001	0.0000001	0.0
30	-0.00000032	0.0000003	-0.0000001	0.0	0.0000001	-0.0000001
31	-0.00000010	-0.0000008	0.0	-0.0000001	-0.0000001	0.0000001
32	0.00000011	-0.0000004	0.0	0.0	0.0	0.0
33	0.00000006	0.0000001	0.0	0.0	-0.0000001	0.0
34	-0.00000003	0.0	0.0	0.0000001	0.0	-0.0000001
35	-0.00000002	-0.0000002	0.0	0.0	0.0000001	0.0

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 274 THRU 305 JD 2443417.5 TO 2443449.5 DATES OCT 1 THRU NOV 1

A = 16.00000000 B = -18.12500000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	O	'			
0	34.35386246	15.7617677	111.7494864	13.2568395	51.9863242	17.5773068
1	14.11992528	-0.2918259	-0.2289015	7.5654384	-1.5158960	-0.2891329
2	-0.06101115	15.2320648	-2.5342758	10.5300648	47.6926639	16.0833446
3	-0.26698352	2.0115893	0.2082977	-46.9772678	10.3746149	2.2767801
4	0.03515016	-8.5327573	1.3164112	-5.7278086	-26.1595550	-8.8087258
5	0.12673014	-0.4756045	-0.3389315	12.3667222	-2.5200646	-0.5296172
6	-0.01053068	1.8008807	-0.2019293	0.8765479	4.6815953	1.5711323
7	-0.05941529	0.0184077	0.1986991	-1.9157296	0.2634425	0.0397860
8	0.00218253	-0.4198051	0.0215455	-0.0415340	-0.7402516	-0.2460240
9	0.02116094	0.0373178	-0.0688646	0.3304842	0.0202223	0.0148965
10	-0.00083584	0.1259518	0.0010866	-0.0358216	0.1359210	0.0441103
11	-0.00677162	-0.0231933	0.0200063	-0.0615165	-0.0278492	-0.0107502
12	0.00045875	-0.0404365	-0.0028290	0.0203980	-0.0250844	-0.0077999
13	0.00240294	0.0095812	-0.0052118	0.0110285	0.0118703	0.0042047
14	-0.00020891	0.0129117	0.0016266	-0.0072837	0.0043181	0.0012494
15	-0.00092018	-0.0035447	0.0011971	-0.0017232	-0.0038258	-0.0013098
16	0.00008630	-0.0041672	-0.0006915	0.0021762	-0.0005676	-0.0001340
17	0.00035355	0.0012748	-0.0002283	0.0001392	0.0010844	0.0003628
18	-0.00003652	0.0013985	0.0002497	-0.0005881	-0.0000081	-0.0000172
19	-0.00013547	-0.0004525	0.0000259	0.0000506	-0.0002816	-0.0000921
20	0.00001596	-0.0004884	-0.0000803	0.0001462	0.0000453	0.0000185
21	0.00005250	0.0001604	0.0000055	-0.0000367	0.0000670	0.0000213
22	-0.00000694	0.0001759	0.0000234	-0.0000329	-0.0000231	-0.0000084
23	-0.00002064	-0.0000576	-0.0000055	0.0000154	-0.0000142	-0.0000042
24	0.00000299	-0.0000653	-0.0000062	0.0000063	0.0000088	0.0000029
25	0.00000813	0.0000211	0.0000026	-0.0000054	0.0000024	0.0000006
26	-0.00000128	0.0000244	0.0000014	-0.0000009	-0.0000028	-0.0000009
27	-0.00000325	-0.0000081	-0.0000010	0.0000016	-0.0000002	0.0
28	0.00000055	-0.0000093	-0.0000002	0.0	0.0000009	0.0000003
29	0.00000131	0.0000033	0.0000003	-0.0000005	0.0	-0.0000001
30	-0.00000024	0.0000035	-0.0000001	0.0000001	-0.0000003	0.0
31	-0.00000052	-0.0000012	-0.0000001	0.0000001	0.0000001	0.0
32	0.00000008	-0.0000014	0.0	0.0	0.0000001	0.0
33	0.00000023	0.0000005	-0.0000001	0.0	0.0000001	0.0
34	-0.00000003	0.0000007	-0.0000001	0.0000001	0.0	0.0
35	-0.00000008	-0.0000002	-0.0000001	-0.0000001	0.0	0.0

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 305 THRU 336 JD 2443448.5 TO 2443480.5 DATES NOV 1 THRU DEC 2

A = 16.00000000 B = -20.06250000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	40.64823482	13.3063969	112.1458472	-24.5306993	46.9736704	15.1051115
1	14.09989558	1.7325778	-0.6379095	5.7213292	4.5508122	1.7542616
2	-0.25761486	12.0540620	-2.0935274	-30.2039971	40.1103546	12.6836322
3	-0.22356103	-9.1678369	1.9715649	-39.2883189	-26.1023011	-9.5983235
4	0.18046300	-6.4517946	0.8421463	16.9458988	-21.5171687	-6.7641826
5	0.04077682	2.9434111	-0.7768588	9.4985444	7.5641738	2.7259582
6	-0.11355087	0.9281552	0.1039835	-3.6290959	3.1092242	0.9473203
7	0.00375888	-0.7991031	0.2477303	-0.8980863	-1.5464951	-0.5335982
8	0.04679893	0.0362193	-0.1123119	0.7598949	-0.1609985	-0.0355713
9	-0.00761453	0.2415720	-0.0515607	-0.0329671	0.3308603	0.1090669
10	-0.01299433	-0.1011482	0.0457203	-0.1529772	-0.0612170	-0.0239275
11	0.00564353	-0.0645847	0.0024408	0.0542314	-0.0596856	-0.0185528
12	0.00269010	0.0544221	-0.0141282	0.0226264	0.0338811	0.0117880
13	-0.00308260	0.0104161	0.0035339	-0.0210253	0.0060888	0.0015305
14	-0.00018743	-0.0213008	0.0032089	-0.0003026	-0.0107614	-0.0035823
15	0.00134106	0.0019771	-0.0021018	0.0056869	0.0012621	0.0005532
16	-0.00025244	0.0069777	-0.0003575	-0.0014570	0.0025241	0.0008041
17	-0.00047039	-0.0027207	0.0007743	-0.0011222	-0.0010351	-0.0003707
18	0.00021877	-0.0018612	-0.0001216	0.0007119	-0.0003929	-0.0001137
19	0.00012615	0.0015445	-0.0002078	0.0001050	0.0003976	0.0001349
20	-0.00012327	0.0003023	0.0001009	-0.0002291	-0.0000050	-0.0000072
21	-0.00001667	-0.0006680	0.0000353	0.0000364	-0.0001108	-0.0000360
22	0.00005590	0.0000603	-0.0000425	0.0000545	0.0000332	0.0000124
23	-0.00000840	0.0002404	0.0000018	-0.0000259	0.0000219	0.0000068
24	-0.00002099	-0.0000878	0.0000130	-0.0000079	-0.0000159	-0.0000054
25	0.00000918	-0.0000702	-0.0000045	0.0000097	-0.0000016	-0.0000003
26	0.00000621	0.0000538	-0.0000028	-0.0000006	0.0000050	0.0000015
27	-0.00000555	0.0000133	0.0000023	-0.0000027	-0.0000010	-0.0000005
28	-0.00000107	-0.0000251	0.0000002	0.0000010	-0.0000011	-0.0000004
29	0.00000262	0.0000014	-0.0000009	0.0000006	0.0000007	0.0000003
30	-0.00000027	0.0000097	0.0000002	-0.0000005	0.0000001	0.0
31	-0.00000101	-0.0000031	0.0000004	0.0	-0.0000002	-0.0000001
32	0.00000041	-0.0000032	-0.0000001	0.0000002	0.0000001	0.0
33	0.00000033	0.0000021	0.0	0.0	0.0	0.0
34	-0.00000024	0.0000007	0.0	0.0	-0.0000001	0.0
35	-0.00000007	-0.0000011	0.0	-0.0000001	0.0000001	0.0

CHEBYSHEV APPROXIMATION OF LUNAR COORDINATES FOR YEAR 1977

DAYS 335 THRU 366 JD 2443478.5 TO 2443510.5 DATES DEC 1 THRU JAN 1

A = 16.00000000 B = -21.93750000

CHEBYSHEV COEFFICIENTS

	R A	DEC	H P	X	Y	Z
	H	0	'			
0	45.22899417	6.7654413	113.0442066	-44.0539782	26.7523186	8.1407359
1	14.06945668	2.4142059	-0.7719956	1.5990550	6.6592849	2.4077505
2	-0.38064784	4.6056336	-1.1444825	-49.0995502	16.7313599	4.6854226
3	-0.14533085	-14.0504566	2.7130333	-16.3621067	-43.1063224	-14.7224141
4	0.22223656	-2.0269053	0.1954862	26.8087518	-8.3108973	-2.2585731
5	-0.06418463	3.8764406	-0.8656319	2.7256191	11.1906848	3.7729417
6	-0.08397828	-0.3550951	0.3322766	-4.5363999	0.1260088	-0.0482860
7	0.07100155	-0.5988019	0.1806506	0.5565413	-1.5099467	-0.4906232
8	0.01947169	0.3891771	-0.1717539	0.5176918	0.4761179	0.1692463
9	-0.02775615	-0.0086493	-0.0032658	-0.3196082	0.1287906	0.0364823
10	0.00246131	-0.1581067	0.0491434	-0.0057266	-0.1637033	-0.0547214
11	0.00695107	0.0691761	-0.0173500	0.0835228	0.0252784	0.0101054
12	-0.00429794	0.0369994	-0.0083170	-0.0271811	0.0344015	0.0109340
13	-0.00047880	-0.0367721	0.0086411	-0.0131456	-0.0180851	-0.0062950
14	0.00216133	0.0007846	-0.0006382	0.0114298	-0.0031350	-0.0008169
15	-0.00070772	0.0120577	-0.0025149	-0.0003680	0.0057890	0.0019235
16	-0.00062479	-0.0055337	0.0011370	-0.0029165	-0.0011651	-0.0004478
17	0.00051403	-0.0020552	0.0003777	0.0011320	-0.0011672	-0.0003665
18	0.00003192	0.0030773	-0.0005000	0.0004089	0.0007408	0.0002558
19	-0.00021130	-0.0004873	0.0000676	-0.0004659	0.0000660	0.0000124
20	0.00008348	-0.0010023	0.0001342	0.0000487	-0.0002350	-0.0000777
21	0.00004946	0.0005930	-0.0000724	0.0001169	0.0000643	0.0000240
22	-0.00005789	0.0001384	-0.0000159	-0.0000551	0.0000453	0.0000140
23	0.00000425	-0.0002858	0.0000293	-0.0000147	-0.0000344	-0.0000119
24	0.00002252	0.0000693	-0.0000057	0.0000209	-0.0000011	-0.0
25	-0.00001138	0.0000833	-0.0000072	-0.0000030	0.0000103	0.0000034
26	-0.00000441	-0.0000639	0.0000047	-0.0000049	-0.0000032	-0.0000013
27	0.00000666	-0.0000058	0.0000007	0.0000027	-0.0000018	-0.0000005
28	-0.00000112	0.0000284	-0.0000019	0.0000005	0.0000015	0.0000005
29	-0.00000232	-0.0000097	0.0000003	-0.0000010	0.0	0.0
30	0.00000149	-0.0000071	0.0000005	0.0000001	-0.0000005	-0.0000001
31	0.00000035	0.0000070	-0.0000004	0.0000003	0.0000001	0.0000001
32	-0.00000079	0.0	0.0000001	-0.0000001	0.0000001	-0.0000001
33	0.00000020	-0.0000026	0.0	0.0	0.0	0.0
34	0.00000025	0.0000012	0.0000001	0.0000001	0.0	0.0
35	-0.00000021	0.0000006	0.0000001	0.0	0.0	0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MERCURY AND VENUS

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	MERCURY R A	MERCURY DEC	MERCURY DISTANCE	VENUS R A	VENUS DEC	VENUS DISTANCE
	H	O	AU	H	O	AU
0	43.4231281	-19.559334	2.0800109	48.1058029	8.060596	1.0775479
1	3.7278612	17.103467	0.2581086	1.5637019	15.525845	-0.3031799
2	1.0582970	8.446105	-0.2104103	-0.6834769	-4.321497	0.0299303
3	-0.4817698	0.686679	-0.1035536	-0.1345989	-1.639392	0.0136774
4	0.1313421	-1.319526	0.0225940	-0.0094744	-0.203310	0.0034127
5	-0.0197276	-0.047532	-0.0227430	0.0158914	-0.004882	0.0005201
6	-0.0535356	-0.132950	0.0105178	0.0091615	0.037041	-0.0000524
7	0.0328016	-0.057023	0.0015967	0.0024609	0.024062	-0.0000908
8	-0.0217808	0.031060	-0.0002416	-0.0000174	0.008443	-0.0000250
9	0.0084875	-0.000130	0.0015518	-0.0002447	0.001759	0.0000064
10	0.0000687	0.005706	-0.0008995	-0.0000897	-0.000182	-0.0000088
11	-0.0020532	0.005110	0.0001954	-0.0000778	-0.000652	-0.0000068
12	0.0023512	-0.002501	-0.0001108	-0.0000439	-0.000397	0.0000030
13	-0.0014163	0.000574	-0.0000784	0.0000029	-0.000086	0.0000024
14	0.0005278	-0.000271	0.0000657	0.0000149	0.000029	0.0
15	-0.0000612	-0.000690	-0.0000347	0.0000065	0.000027	-0.0000005
16	-0.0001585	0.000429	0.0000229	-0.0000006	0.000015	-0.0000002
17	0.0001634	-0.000229	-0.0000011	-0.0000005	0.000005	0.0
18	-0.0001044	0.000073	-0.0000028	-0.0000030	-0.000016	-0.0000002
19	0.0000444	0.000067	0.0000038	-0.0000020	-0.000013	0.0000002
20	-0.0000014	-0.000051	-0.0000030	0.0000025	0.000013	0.0000003
21	-0.0000113	0.000044	0.0000007	0.0000013	0.000010	-0.0000001
22	0.0000110	-0.000028	-0.0000003	-0.0000014	-0.000006	-0.0000001
23	-0.0000079	0.000005	0.0	-0.0000008	-0.000005	0.0000001
24	0.0000039	0.000008	0.0000001	0.0000005	0.000002	0.0
25	-0.0000005	-0.000010	-0.0000001	0.0000001	0.000002	0.0
26	-0.0000008	0.000005	0.0000001	0.0	-0.000001	0.0
27	0.0000006	-0.000004	0.0	-0.0000004	-0.000004	0.0
28	-0.0000008	-0.000002	0.0	-0.0000003	-0.000001	0.0
29	0.0000002	0.000003	0.0	0.0000002	0.000003	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MERCURY AND VENUS

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	MERCURY R A	MERCURY DEC	MERCURY DISTANCE	VENUS R A	VENUS DEC.	VENUS DISTANCE
	H	O	AU	H	O	AU
0	7.3218684	34.762077	1.9569051	3.3617628	22.405398	1.0508965
1	2.3720449	4.679896	0.2170446	1.5033780	1.654066	0.3039532
2	1.0636797	3.063824	0.2814413	0.7172309	5.318221	0.0448481
3	0.5388332	1.856927	-0.1270920	-0.1346465	-0.928817	-0.0173474
4	-0.2693405	-3.413284	-0.0335549	-0.0001005	-0.443055	0.0034382
5	0.0042844	-0.169052	0.0069119	0.0200063	0.267110	-0.0001605
6	0.0397473	0.566345	-0.0072208	-0.0101785	-0.082415	-0.0002738
7	-0.0393064	-0.184386	0.0011872	0.0022479	0.003083	0.0001623
8	-0.0041537	-0.060271	0.0024702	0.0003290	0.012157	-0.0000279
9	0.0116387	0.112552	0.0004545	-0.0003779	-0.006767	-0.0000127
10	-0.0019412	-0.000779	-0.0002591	0.0001315	0.001568	-0.0000049
11	-0.0016737	-0.034765	0.0000215	-0.0000835	-0.000040	0.0000040
12	0.0018887	0.012305	-0.0000094	0.0000331	-0.000163	0.0000039
13	-0.0000902	0.004995	-0.0001145	0.0000146	0.000216	-0.0000023
14	-0.0006621	-0.007808	0.0000012	-0.0000172	-0.000138	-0.0000010
15	0.0002135	0.001021	0.0000252	0.0000030	0.000012	0.0000006
16	0.0000817	0.002451	-0.0000031	0.0000019	0.000028	-0.0000001
17	-0.0001183	-0.001179	0.0000017	-0.0000027	-0.000022	0.0
18	0.0000273	-0.000287	0.0000049	0.0000030	0.000017	0.0000003
19	0.0000375	0.000593	-0.0000013	0.0000021	0.000017	-0.0000004
20	-0.0000212	-0.000146	-0.0000020	-0.0000038	-0.000027	-0.0000003
21	-0.0000041	-0.000180	0.0000004	-0.0000010	-0.000006	0.0000003
22	0.0000093	0.000124	0.0000002	0.0000025	0.000017	0.0000002
23	-0.0000023	0.000018	-0.0000003	0.0	-0.000003	-0.0000001
24	-0.0000026	-0.000053	0.0	-0.0000015	-0.000010	0.0
25	0.0000017	0.000012	0.0000001	0.0000002	0.000002	-0.0000001
26	0.0000004	0.000012	0.0	0.0000004	0.0	-0.0000001
27	-0.0000006	-0.000012	0.0	-0.0000003	0.000002	0.0
28	0.0000002	-0.000001	0.0	0.0000003	0.000003	0.0
29	0.0000003	0.000008	0.0	-0.0000001	-0.000002	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MERCURY AND VENUS

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	MERCURY R A	MERCURY DEC	MERCURY DISTANCE	VENUS R A	VENUS DEC	VENUS DISTANCE
	H	O	AU	H	O	AU
0	20.0626938	21.183346	2.0941777	14.4767708	32.807397	2.3192826
1	2.0565996	-9.990230	-0.1347839	3.8139713	-4.222189	0.3132581
2	-0.8687196	5.638451	0.2811274	0.0274960	-4.821559	-0.0194294
3	0.5898227	-0.952554	0.1270136	-0.0427936	-0.015756	-0.0013501
4	0.2989381	-3.567845	-0.0213859	0.0036492	0.162889	0.0001388
5	0.0255081	-0.692331	-0.0294197	0.0024337	-0.003397	0.0000060
6	-0.0922145	0.517756	-0.0177002	-0.0000999	-0.004188	0.0000018
7	-0.0616357	0.572377	0.0015893	-0.0001717	0.000023	0.0000130
8	0.0045560	0.102163	0.0050164	0.0000780	0.000129	0.0000054
9	0.0217774	-0.152055	0.0021378	0.0000239	-0.000032	-0.0000173
10	0.0098074	-0.105175	-0.0002486	-0.0000433	0.000054	-0.0000036
11	-0.0029856	0.002944	-0.0007552	-0.0000030	0.000042	0.0000073
12	-0.0048438	0.040929	-0.0002276	0.0000136	-0.000020	0.0000010
13	-0.0011742	0.017260	0.0000974	-0.0000007	-0.000015	-0.0000018
14	0.0011698	-0.007885	0.0001006	-0.0000026	0.000016	0.0000003
15	0.0009693	-0.010450	0.0000029	-0.0000006	0.000006	0.0000003
16	-0.0000005	-0.001668	-0.0000334	0.0	0.000001	0.0000001
17	-0.0003672	0.003570	-0.0000113	0.0000003	-0.000001	0.0
18	-0.0001665	0.002399	0.0000094	0.0000002	-0.000007	-0.0000003
19	0.0000677	-0.000343	0.0000093	0.0000004	-0.000001	0.0000001
20	0.0000975	-0.001187	0.0000006	0.0	0.000006	0.0000003
21	0.0000187	-0.000448	-0.0000037	-0.0000005	0.0	0.0
22	-0.0000295	0.000279	-0.0000025	0.0	-0.000003	-0.0000001
23	-0.0000229	0.000334	0.0000003	0.0000001	0.0	-0.0000001
24	0.0000003	0.000050	0.0000011	-0.0000001	-0.000001	0.0000001
25	0.0000096	-0.000119	0.0000004	-0.0000001	0.000001	0.0
26	0.0000047	-0.000083	-0.0000002	-0.0000003	-0.000003	-0.0000001
27	-0.0000015	0.000012	-0.0000003	0.0000002	-0.000001	0.0
28	-0.0000026	0.000039	-0.0000001	0.0000002	-0.000002	-0.0000001
29	-0.0000007	0.000014	0.0	0.0	0.000004	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MERCURY AND VENUS

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	MERCURY R A	MERCURY DEC	MERCURY DISTANCE	VENUS R A	VENUS DEC	VENUS DISTANCE
	H	0	AU	H	0	AU
0	31.2333844	-30.123035	2.2120912	29.2320343	-20.642093	3.1901293
1	3.1398074	-11.637506	-0.3250393	3.9035727	-17.090150	0.1326495
2	-1.1680631	8.134306	-0.1233266	0.1240637	2.984541	-0.0243262
3	-0.4649320	-0.381728	0.1476363	0.0163787	0.918445	0.0003216
4	-0.0040287	-1.232174	0.0620832	-0.0103245	-0.023628	0.0000467
5	0.1792390	-0.355256	0.0211905	-0.0019872	-0.016442	0.0000003
6	0.1391657	-0.112624	-0.0091571	0.0001627	-0.003623	-0.0000007
7	0.0398156	0.054691	-0.0123342	0.0001131	-0.000045	0.0000144
8	-0.0175489	0.033249	-0.0062539	0.0000700	0.000033	-0.0000013
9	-0.0316868	0.027100	-0.0007491	-0.0000046	0.000066	-0.0000175
10	-0.0190706	0.017353	0.0017966	-0.0000329	0.000093	0.0000012
11	-0.0033594	0.010007	0.0016308	0.0000010	-0.000036	0.0000072
12	0.0051657	0.002005	0.0006599	0.0000094	-0.000022	-0.0000002
13	0.0058692	-0.004214	-0.0000930	0.0000007	0.000014	-0.0000015
14	0.0028799	-0.005893	-0.0003264	0.0	0.000002	-0.0000001
15	-0.0000211	-0.003970	-0.0002319	-0.0000002	-0.000004	0.0
16	-0.0012734	-0.000823	-0.0000644	0.0	-0.000003	-0.0000002
17	-0.0011098	0.001297	0.0000384	-0.0000010	-0.000004	-0.0000003
18	-0.0004191	0.001731	0.0000585	-0.0000015	0.000010	0.0000004
19	0.0001237	0.001017	0.0000339	0.0000010	0.000001	0.0000002
20	0.0002979	0.000086	0.0000045	0.0000021	-0.000010	-0.0000004
21	0.0002067	-0.000429	-0.0000100	-0.0000009	-0.000001	-0.0000002
22	0.0000508	-0.000449	-0.0000103	-0.0000012	0.000004	0.0
23	-0.0000467	-0.000214	-0.0000047	0.0000001	0.0	0.0000001
24	-0.0000649	0.000021	0.0000002	0.0000003	-0.000003	0.0
25	-0.0000377	0.000124	0.0000021	0.0000002	0.000002	0.0
26	-0.0000041	0.000107	0.0000019	0.0	0.000001	0.0
27	0.0000139	0.000042	0.0000007	0.0000003	-0.000001	0.0
28	0.0000141	-0.000017	-0.0000003	0.0000001	-0.000002	0.0
29	0.0000063	-0.000035	-0.0000005	-0.0000003	0.000002	0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MARS AND JUPITER

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	MARS R A	MARS DEC	MARS DISTANCE	JUPITER R A	JUPITER DEC	JUPITER DISTANCE
	H	O	AU	H	O	AU
0	41.0823393	-35.557548	4.5482594	6.9801904	36.209730	10.0542284
1	2.5067979	8.336571	-0.1564333	0.3095857	1.276944	0.7135549
2	-0.0451144	1.905682	-0.0039069	0.1041588	0.326374	-0.0093804
3	-0.0068826	-0.172273	0.0013001	-0.0078224	-0.051698	-0.0168038
4	0.0023055	-0.020291	-0.0001482	-0.0005532	-0.003529	0.0011174
5	0.0000003	0.002713	-0.0000091	0.0002148	0.001338	0.0000352
6	-0.0000568	0.000003	0.0000055	-0.0000416	-0.000159	-0.0000213
7	-0.0000139	-0.000105	0.0000018	0.0000031	0.000004	-0.0000009
8	0.0000039	0.000076	0.0000184	-0.0000119	-0.000031	-0.0000026
9	0.0000323	0.000100	-0.0000032	-0.0000022	-0.000017	0.0000193
10	-0.0000047	-0.000036	-0.0000140	0.0000124	0.000027	0.0000022
11	-0.0000152	-0.000047	0.0000018	0.0000003	-0.000005	-0.0000116
12	0.0000023	0.000006	0.0000047	-0.0000043	-0.000011	-0.0000008
13	0.0000039	0.000022	-0.0000004	-0.0000002	0.0	0.0000036
14	0.0000016	0.000004	-0.0000010	0.0000020	0.000007	0.0000004
15	-0.0000008	-0.000007	-0.0000001	0.0000001	0.000006	-0.0000006
16	-0.0000011	-0.000001	0.0000002	-0.0000007	-0.000004	-0.0000002
17	0.0000006	-0.000005	-0.0000002	0.0000002	0.000002	0.0000002
18	-0.0000019	-0.000007	0.0	-0.0000009	-0.000002	-0.0000003
19	-0.0000001	0.000009	0.0000003	-0.0000001	-0.000008	-0.0000001
20	0.0000020	0.000005	0.0	0.0000016	0.000008	0.0000003
21	-0.0000003	-0.000006	-0.0000002	0.0	0.000005	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MARS AND JUPITER

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	MARS R A	MARS DEC	MARS DISTANCE	JUPITER R A	JUPITER DEC	JUPITER DISTANCE
	H	O	AU	H	O	AU
0	50.0191909	9.240639	3.9315768	9.1197317	42.443402	11.8745382
1	2.2453384	13.438419	-0.1688291	0.7547967	1.637284	0.1753496
2	-0.0022526	-0.595401	-0.0035711	0.0165810	-0.175728	-0.1078604
3	0.0061955	-0.204542	-0.0011649	-0.0065842	-0.022155	-0.0017476
4	-0.0008642	0.007843	-0.0001182	0.0000733	0.003627	0.0007097
5	-0.0001737	0.000636	0.0000244	-0.0000375	-0.000019	-0.0000236
6	0.0000107	0.000084	0.0000041	0.0	0.000003	0.0000131
7	-0.0000118	-0.000063	0.0000075	-0.0000030	-0.000002	-0.0000006
8	0.0000270	0.000128	0.0000130	-0.0000008	-0.000009	0.0000161
9	0.0000249	0.000091	-0.0000137	0.0000119	0.000017	0.0000028
10	-0.0000178	-0.000088	-0.0000099	0.0000016	0.000009	-0.0000159
11	-0.0000132	-0.000037	0.0000062	-0.0000082	-0.000003	-0.0000015
12	0.0000049	0.000031	0.0000034	-0.0000014	-0.000010	0.0000062
13	0.0000038	0.000011	-0.0000019	0.0000016	0.000006	0.0000005
14	-0.0000021	-0.000019	-0.0000010	-0.0000008	-0.000004	-0.0000018
15	-0.0000002	0.0	0.0000005	0.0000005	-0.000005	-0.0000002
16	0.0000008	-0.000002	0.0	0.0000004	0.000004	0.0000003
17	0.0000003	0.000002	0.0000002	0.0000002	0.000001	0.0
18	0.0000017	0.000013	0.0000003	0.0000010	0.000007	0.0000004
19	-0.0000001	-0.000002	-0.0000004	-0.0000007	0.000004	0.0000001
20	-0.0000014	-0.000011	-0.0000003	-0.0000007	-0.000006	-0.0000004
21	0.0000001	0.0	0.0000003	0.0000006	-0.000001	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MARS AND JUPITER

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	MARS R A	MARS DEC	MARS DISTANCE	JUPITER R A	JUPITER DEC	JUPITER DISTANCE
	H	0	AU	H	0	AU
0	10.5589420	42.478631	3.1403019	11.7903266	45.801003	11.0734208
1	2.1724293	3.092732	-0.2557189	0.5764218	0.152537	-0.5625204
2	-0.0549075	-1.645252	-0.0183254	-0.0671445	-0.128358	-0.0663794
3	-0.0152734	0.071175	-0.0006626	-0.0088594	0.027360	0.0096117
4	-0.0008145	0.026131	0.0001992	-0.0002484	0.002067	0.0009714
5	0.0001512	-0.000106	0.0000372	0.0000254	-0.000332	0.0000562
6	0.0000017	-0.000213	-0.0000003	0.0000185	-0.000057	-0.0000009
7	0.0000044	-0.000079	0.0000091	0.0000028	-0.000010	0.0000033
8	0.0000465	0.000034	-0.0000040	0.0000115	-0.000009	-0.0000011
9	-0.0000074	0.000046	-0.0000188	0.0000008	0.000021	-0.0000193
10	-0.0000382	-0.000011	0.0000026	-0.0000122	0.000004	0.0000005
11	0.0000024	0.000001	0.0000096	0.0000005	-0.000003	0.0000115
12	0.0000132	0.000002	-0.0000008	0.0000045	0.000006	0.0000001
13	-0.0000005	-0.000005	-0.0000024	0.0000007	0.000003	-0.0000034
14	-0.0000026	0.000009	0.0000003	-0.0000014	0.000008	0.0000002
15	-0.0000006	0.0	0.0000004	-0.0000010	-0.000002	0.0000006
16	-0.0000001	-0.000005	-0.0000001	0.0000001	-0.000005	-0.0000001
17	0.0	-0.000001	-0.0000001	-0.0000005	-0.000001	-0.0000001
18	-0.0000001	-0.000006	-0.0000003	0.0000003	-0.000008	-0.0000003
19	0.0000007	0.000001	0.0000001	0.0000013	-0.000002	0.0
20	0.0	0.000013	0.0000004	-0.0000002	0.000007	0.0000003
21	-0.0000008	0.0	-0.0000001	-0.0000011	-0.000001	-0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
MARS AND JUPITER

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	MARS R A	MARS DEC	MARS DISTANCE	JUPITER R A	JUPITER DEC	JUPITER DISTANCE
	H	0	AU	H	0	AU
0	16.7444037	42.811803	1.9594020	12.5387773	46.104504	8.9019111
1	0.8006112	-0.730940	-0.3290603	-0.2236498	0.144841	-0.4095286
2	-0.3463718	1.123775	0.0160374	-0.1021467	0.036517	0.1222956
3	-0.0434354	0.311544	0.0097664	0.0146141	-0.020647	0.0172458
4	-0.0019268	-0.032593	0.0015526	0.0040071	-0.003351	-0.0016322
5	0.0015534	-0.019531	0.0001063	0.0000070	0.001634	-0.0004415
6	0.0007055	-0.004762	-0.0000315	-0.0001315	0.000283	-0.0000156
7	0.0001774	-0.000539	-0.0000130	-0.0000140	-0.000054	0.0000091
8	-0.0000042	0.000344	-0.0000192	-0.0000064	-0.000008	-0.0000099
9	-0.0000862	0.000315	0.0000021	-0.0000131	-0.000006	0.0000115
10	-0.0000022	-0.000090	0.0000164	0.0000093	-0.000022	0.0000135
11	0.0000461	-0.000166	-0.0000012	0.0000093	-0.000007	-0.0000080
12	0.0000051	0.000016	-0.0000064	-0.0000031	0.000008	-0.0000060
13	-0.0000124	0.000053	-0.0000001	-0.0000031	0.0	0.0000023
14	-0.0000026	0.000005	0.0000012	0.0000016	-0.000005	0.0000015
15	0.0000015	-0.000003	0.0000003	0.0000010	0.000006	-0.0000002
16	0.0000002	0.0	-0.0000001	-0.0000007	0.000003	-0.0000001
17	-0.0000001	0.000001	0.0000002	0.0000002	-0.000003	0.0000002
18	0.0000007	0.000001	0.0000002	-0.0000009	0.0	0.0000001
19	0.0000007	-0.000005	-0.0000005	-0.0000001	-0.000009	-0.0000005
20	0.0	-0.000001	-0.0000002	0.0000015	0.000003	0.0000001
21	-0.0000011	0.000012	0.0000004	0.0	0.000010	0.0000004

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
SATURN AND URANUS

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	SATURN R A	SATURN DEC	SATURN DISTANCE	URANUS R A	URANUS DEC	URANUS DISTANCE
	H	0	AU	H	0	AU
0	18.0422902	35.870129	16.6987254	29.2009637	-29.580038	36.5931326
1	-0.2069466	0.930704	0.2018879	-0.0049557	0.034940	-0.7109712
2	0.0217229	-0.123453	0.1582739	-0.0317122	0.148490	0.0471251
3	0.0118064	-0.046254	-0.0079455	0.0008641	-0.004561	0.0216742
4	-0.0007599	0.005152	-0.0028646	0.0005409	-0.002253	-0.0005516
5	-0.0002196	0.000635	0.0001889	0.0000078	-0.000049	-0.0002080
6	0.0000222	-0.000163	0.0000244	-0.0000030	0.000006	0.0000002
7	0.0000052	-0.000011	-0.0000049	-0.0000002	-0.000001	0.0000042
8	-0.0000012	0.000017	-0.0000145	0.0000026	-0.000006	-0.0000006
9	-0.0000095	0.000029	0.0000011	0.0000001	0.000005	-0.0000193
10	-0.0000005	-0.000011	0.0000171	-0.0000042	0.000017	0.0000022
11	0.0000057	-0.000026	-0.0000010	0.0000002	0.000003	0.0000130
12	0.0000007	0.000004	-0.0000075	0.0000028	-0.000011	0.0
13	-0.0000023	0.000008	0.0000002	0.0000002	-0.000002	-0.0000027
14	0.0000008	-0.000002	0.0000019	0.0000008	-0.000005	-0.0000008
15	0.0000007	0.000002	0.0000002	0.0	-0.000005	0.0000002
16	-0.0000006	0.000003	-0.0000003	-0.0000004	0.000003	-0.0000001
17	0.0000004	-0.000002	0.0	0.0	-0.000001	-0.0000002
18	-0.0000014	0.000002	0.0	-0.0000014	0.000005	0.0000004
19	-0.0000001	-0.000006	-0.0000004	0.0000003	0.000005	0.0000011
20	0.0000012	-0.000003	0.0	0.0000014	-0.000007	-0.0000004
21	-0.0000003	0.000006	0.0000005	0.0	-0.000003	0.0000003

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
SATURN AND URANUS

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	SATURN R A	SATURN DEC	SATURN DISTANCE	URANUS R A	URANUS DEC	URANUS DISTANCE
	H	0	AU	H	0	AU
0	17.9639882	36.261225	18.7056233	28.9245822	-28.246287	35.5273344
1	0.1887737	-0.798029	0.7090224	-0.1087240	0.516770	0.2261667
2	0.0544378	-0.233156	-0.0370485	0.0107081	-0.053056	0.1501393
3	-0.0043311	0.013156	-0.0166510	0.0045210	-0.022461	-0.0076342
4	-0.0003765	0.001001	0.0010111	-0.0002647	0.001112	-0.0021793
5	0.0000819	-0.000114	0.0000315	-0.0000450	0.000264	0.0001107
6	-0.0000117	0.000048	-0.0000074	0.0000048	-0.000022	0.0000033
7	0.0000004	-0.000001	-0.0000015	0.0000008	-0.000007	-0.0000021
8	-0.0000054	0.000020	0.0000051	-0.0000001	-0.000001	-0.0000142
9	0.0000009	-0.000010	0.0000184	-0.0000051	0.000020	0.0000081
10	0.0000070	-0.000018	-0.0000058	0.0000014	-0.000008	0.0000159
11	-0.0000019	0.000018	-0.0000107	0.0000021	-0.000011	-0.0000044
12	-0.0000036	0.000009	0.0000024	-0.0000016	0.000006	-0.0000078
13	0.0000005	-0.000001	0.0000037	-0.0000010	0.000004	0.0000009
14	-0.0000006	-0.000001	-0.0000008	-0.0000008	0.000006	0.0000017
15	0.0000007	-0.000008	-0.0000010	0.0000014	0.000001	0.0000002
16	0.0000003	-0.000002	0.0000002	0.0000003	-0.000004	-0.0000010
17	0.0000002	-0.000002	0.0	0.0000002	-0.000001	0.0
18	0.0000009	0.0	0.0000001	0.0000007	-0.000007	-0.0000004
19	-0.0000006	0.000008	0.0000004	-0.0000007	0.000002	-0.0000009
20	-0.0000011	0.0	-0.0000002	-0.0000007	0.000009	-0.0000004
21	0.0000006	-0.000005	-0.0000004	0.0000012	0.000002	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
SATURN AND URANUS

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	SATURN R A	SATURN DEC	SATURN DISTANCE	URANUS R A	URANUS DEC	URANUS DISTANCE
	H	0	AU	H	0	AU
0	19.1469539	30.951490	20.1153929	28.8434134	-27.929127	37.6091588
1	0.3840555	-1.803050	-0.0443629	0.0794541	-0.413552	0.7124365
2	-0.0042154	-0.006805	-0.1312247	0.0281084	-0.135257	-0.0412140
3	-0.0051207	0.026991	0.0004863	-0.0014396	0.008780	-0.0186477
4	0.0000008	0.001094	0.0011816	-0.0002923	0.001574	0.0006506
5	-0.0000129	0.000011	0.0000292	0.0000161	-0.000119	0.0001005
6	0.0000025	-0.000028	0.0000101	-0.0000023	0.000011	0.0000053
7	-0.0000007	0.000003	0.0000020	-0.0000001	-0.000001	-0.0000016
8	0.0000033	-0.000026	0.0000114	-0.0000020	0.000009	0.0000124
9	0.0000068	-0.000019	-0.0000125	0.0000042	-0.000017	0.0000122
10	-0.0000036	0.000018	-0.0000127	0.0000023	-0.000011	-0.0000141
11	-0.0000021	0.000006	0.0000073	-0.0000010	-0.000001	-0.0000070
12	0.0000010	-0.000003	0.0000054	-0.0000014	0.000001	0.0000063
13	0.0000010	-0.000007	-0.0000024	0.0000007	-0.000002	0.0000031
14	-0.0000005	0.000008	-0.0000011	-0.0000005	-0.000005	-0.0000012
15	-0.0000015	0.000007	0.0000006	-0.0000013	0.000009	-0.0000010
16	-0.0000001	-0.000003	0.0000001	0.0	0.000002	0.0000004
17	-0.0000001	0.000002	0.0	-0.0000004	0.000003	-0.0000003
18	0.0000002	-0.000006	-0.0000002	0.0000004	0.000006	0.0000006
19	0.0000018	-0.000006	-0.0000001	0.0000015	-0.000006	0.0000006
20	0.0000001	0.000005	0.0000001	0.0	-0.000006	0.0000005
21	-0.0000010	0.000009	0.0000002	-0.0000014	0.000007	0.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
SATURN AND URANUS

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	SATURN R A	SATURN DEC	SATURN DISTANCE	URANUS R A	URANUS DEC	URANUS DISTANCE
	H	0	AU	H	0	AU
0	20.2212617	25.943734	18.4484498	29.4000586	-30.616438	38.8349672
1	0.1272684	-0.516238	-0.7222533	0.1815299	-0.836988	-0.1631680
2	-0.0592120	0.327658	-0.0100258	-0.0055313	0.038155	-0.1469100
3	-0.0029530	0.017285	0.0200395	-0.0036900	0.016275	0.0036279
4	0.0006318	-0.004617	0.0008916	-0.0000033	-0.000418	0.0019384
5	0.0001065	-0.000698	-0.0001337	0.0000194	-0.000083	0.0000226
6	0.0000062	-0.000009	-0.0000310	0.0000026	-0.000005	-0.0000087
7	-0.0000001	0.000004	0.0	-0.0000001	0.0	0.0000029
8	0.0000011	0.000008	-0.0000142	0.0000026	-0.000006	0.0000009
9	-0.0000073	0.000034	-0.0000054	0.0	-0.000003	-0.0000192
10	-0.0000027	0.000005	0.0000164	-0.0000039	0.000018	0.0000011
11	0.0000043	-0.000023	0.0000033	0.0	0.000006	0.0000124
12	0.0000020	-0.000008	-0.0000068	0.0000026	-0.000008	-0.0000004
13	-0.0000013	0.000004	-0.0000012	0.0000002	0.000002	-0.0000032
14	0.0000004	-0.000006	0.0000014	0.0000007	-0.000004	0.0000001
15	0.0000004	0.000006	0.0000005	0.0000005	-0.000005	-0.0000006
16	-0.0000004	0.000003	-0.0000001	-0.0000008	0.000002	0.0000001
17	0.0000002	0.000002	0.0000001	0.0000002	-0.000001	-0.0000003
18	-0.0000008	0.000006	0.0000003	-0.0000009	0.000003	0.0000018
19	0.0	-0.000005	-0.0000003	0.0	0.000009	-0.0000001
20	0.0000013	-0.000006	-0.0000003	0.0000019	-0.000009	-0.0000011
21	-0.0000002	0.000007	0.0000001	0.0	-0.000007	-0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
NEPTUNE AND PLUTO

DAYS 1 THRU 95 JD 2443144.5 TO 2443239.5 DATES JAN 1 THRU APR 5

A = 47.50000000 B = -1.02105263

CHEBYSHEV COEFFICIENTS

	NEPTUNE R A	NEPTUNE DEC	NEPTUNE DISTANCE	PLUTO R A *	PLUTO DEC *	PLUTO DISTANCE
	H	O	AU	H	O	AU
0	33.9425087	-42.380541	61.0406490	26.53116293	21.4641996	59.9169963
1	0.0509618	-0.046249	-0.7188374	-0.03510196	0.5680077	-0.5314174
2	-0.0199361	0.033227	-0.0464600	-0.01566233	0.0310693	0.1094058
3	-0.0010477	-0.000113	0.0209338	0.00162301	-0.0215453	0.0156583
4	0.0002738	-0.000359	0.0007136	0.00027444	-0.0006752	-0.0017385
5	0.0000126	0.000009	-0.0001725	-0.00001473	0.0002429	-0.0001514
6	-0.0000007	0.000001	0.0000009	-0.00000148	0.0000078	0.0000090
7	-0.0000003	-0.000001	0.0000046	0.00000026	-0.0000043	0.0000030
8	0.0000010	-0.000001	0.0000078	0.00000169	-0.0000032	-0.0000067
9	0.0000018	0.000004	-0.0000171	-0.00000097	0.0000156	-0.0000159
10	-0.0000026	0.000002	-0.0000085	-0.00000195	0.0000039	0.0000082
11	-0.0000007	0.000009	0.0000107	0.00000065	-0.0000096	0.0000098
12	0.0000017	-0.000001	0.0000031	0.00000083	-0.0000017	-0.0000037
13	0.0000001	0.000001	-0.0000026	-0.00000019	0.0000029	-0.0000031
14	0.0000007	0.0	-0.0000014	-0.00000023	0.0000006	0.0000006
15	0.0000001	-0.000008	0.0000009	-0.00000001	-0.0000005	0.0000008
16	-0.0000005	0.000001	0.0000007	0.00000003	-0.0000002	0.0000001
17	0.0000001	-0.000002	-0.0000012	-0.00000001	0.0	-0.0000001
18	-0.0000014	0.0	-0.0000004	0.00000003	-0.0000004	0.0000003
19	0.0000002	0.000007	0.0000008	0.00000004	0.0	-0.0000001
20	0.0000020	-0.000001	-0.0000011	-0.00000003	0.0000004	-0.0000003
21	-0.0000003	-0.000007	-0.0000005	-0.00000003	0.0	0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
NEPTUNE AND PLUTO

DAYS 91 THRU 185 JD 2443234.5 TO 2443329.5 DATES APR 1 THRU JULY 4

A = 47.50000000 B = -2.91578947

CHEBYSHEV COEFFICIENTS

	NEPTUNE R A	NEPTUNE DEC	NEPTUNE DISTANCE	PLUTO R A *	PLUTO DEC *	PLUTO DISTANCE
	H	O	AU	H	O	AU
0	33.8755348	-42.190060	58.9526269	26.32748028	22.8217780	59.8246909
1	-0.0765699	0.125761	-0.2357405	-0.05156978	0.0181944	0.4787825
2	-0.0069460	0.004844	0.1494717	0.01184782	-0.1415034	0.1049644
3	0.0029325	-0.004535	0.0064584	0.00196582	-0.0016820	-0.0151075
4	0.0001061	-0.000173	-0.0021758	-0.00021766	0.0021771	-0.0012745
5	-0.0000271	0.000029	-0.0000413	-0.00001187	-0.0000605	0.0001448
6	0.0000005	-0.000001	0.0000007	0.00000138	-0.0000052	-0.0000056
7	0.0000007	-0.000002	0.0000017	0.00000022	0.0000015	-0.0000025
8	0.0000012	-0.000005	-0.0000145	-0.00000128	0.0000125	-0.0000093
9	-0.0000041	-0.000001	-0.0000051	-0.00000183	-0.0000003	0.0000138
10	-0.0000005	0.000001	0.0000159	0.00000143	-0.0000140	0.0000107
11	0.0000013	-0.000006	0.0000025	0.00000107	0.0000005	-0.0000083
12	-0.0000006	0.000003	-0.0000069	-0.00000061	0.0000057	-0.0000044
13	-0.0000010	-0.000001	-0.0000020	-0.00000037	-0.0000004	0.0000028
14	-0.0000011	0.000007	0.0000016	0.00000023	-0.0000016	0.0000012
15	0.0000012	0.000008	0.0000012	0.00000012	-0.0000001	-0.0000008
16	0.0000006	-0.000004	-0.0000006	-0.00000004	0.0000003	-0.0000002
17	0.0000002	0.0	0.0000006	0.00000001	0.0000002	-0.0000001
18	0.0000008	-0.000007	-0.0000011	-0.00000004	0.0000002	-0.0000002
19	-0.0000011	-0.000008	0.0	-0.00000003	-0.0000001	0.0000004
20	-0.0000012	0.000007	0.0000003	0.00000002	-0.0000002	0.0000003
21	0.0000010	0.000006	-0.0000003	0.00000002	0.0000002	-0.0000003

* ASTROMETRIC POSITION, EQUATOR AND EQUINOX 1950.0

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
NEPTUNE AND PLUTO

DAYS 182 THRU 276 JD 2443325.5 TO 2443420.5 DATES JULY 1 THRU OCT 3

A = 47.50000000 B = -4.83157895

CHEBYSHEV COEFFICIENTS

	NEPTUNE R A	NEPTUNE DEC	NEPTUNE DISTANCE	PLUTO R A *	PLUTO DEC *	PLUTO DISTANCE
	H	0	AU	H	0	AU
0	33.6650409	-41.924822	59.9908483	26.35859836	21.2579532	62.0042209
1	-0.0125657	-0.018933	0.7007201	0.06937258	-0.7463240	0.5041867
2	0.0198696	-0.035596	0.0502156	0.01405587	-0.0281066	-0.0959696
3	0.0007727	-0.000410	-0.0198160	-0.00137864	0.0164637	-0.0139804
4	-0.0002825	0.000627	-0.0006240	-0.00015119	0.0002039	0.0011755
5	-0.0000018	0.000005	0.0001401	0.00000777	-0.0000710	0.0000839
6	0.0000001	0.000003	0.0000047	-0.00000049	-0.0000029	0.0000079
7	-0.0000001	-0.000003	-0.0000023	-0.00000027	0.0000017	-0.0000006
8	-0.0000023	0.000008	0.0000044	-0.00000053	-0.0000055	0.0000137
9	0.0000018	0.0	0.0000186	0.00000218	-0.0000128	0.0000041
10	0.0000028	-0.000002	-0.0000053	0.00000064	0.0000065	-0.0000159
11	0.0000005	-0.000004	-0.0000136	-0.00000137	0.0000079	-0.0000028
12	-0.0000016	-0.000005	0.0000009	-0.00000030	-0.0000030	0.0000067
13	0.0000002	-0.000003	0.0000032	0.00000041	-0.0000026	0.0000007
14	0.0000001	-0.000004	-0.0000013	0.00000004	0.0000010	-0.0000016
15	-0.0000015	-0.000001	0.0	-0.00000008	0.0000003	0.0000001
16	0.0000004	0.000003	0.0000001	0.00000002	0.0	0.0000003
17	-0.0000001	0.000001	0.0000004	0.00000003	0.0000003	0.0000001
18	0.0000002	0.000008	0.0	0.00000002	-0.0000002	-0.0000001
19	0.0000017	-0.000002	-0.0000008	0.00000001	0.0	-0.0000001
20	0.0	-0.000008	0.0000002	-0.00000003	0.0000001	0.0
21	-0.0000012	0.000002	0.0000007	-0.00000002	-0.0000002	0.0000001

CHEBYSHEV APPROXIMATION OF PLANETARY COORDINATES FOR YEAR 1977
NEPTUNE AND PLUTO

DAYS 274 THRU 368 JD 2443417.5 TO 2443512.5 DATES OCT 1 THRU JAN 3

A = 47.50000000 B = -6.76842105

CHEBYSHEV COEFFICIENTS

	NEPTUNE R A	NEPTUNE DEC	NEPTUNE DISTANCE	PLUTO R A *	PLUTO DEC *	PLUTO DISTANCE
	H	0	AU	H	0	AU
0	33.8798206	-42.384493	62.1310796	26.70741378	19.0180513	62.0699984
1	0.1131982	-0.189358	0.2490281	0.09219629	-0.2844117	-0.4851770
2	0.0069553	0.000515	-0.1456688	-0.00947403	0.1311541	-0.1141033
3	-0.0025281	0.004690	-0.0074721	-0.00211979	0.0066126	0.0124700
4	-0.0000958	-0.000116	0.0019761	0.00008402	-0.0016010	0.0017673
5	0.0000145	-0.000047	0.0000866	0.00001890	-0.0001177	-0.0000569
6	0.0000007	0.000004	-0.0000037	0.00000186	-0.0000007	-0.0000177
7	-0.0000009	0.000001	0.0000007	0.00000002	-0.0000006	0.0000018
8	0.0000009	0.0	0.0000086	0.00000165	-0.0000041	-0.0000060
9	0.0000016	0.000003	-0.0000161	-0.00000078	0.0000132	-0.0000165
10	-0.0000024	0.000001	-0.0000091	-0.00000190	0.0000050	0.0000073
11	-0.0000012	0.000008	0.0000104	0.00000055	-0.0000089	0.0000103
12	0.0000019	-0.000002	0.0000040	0.00000079	-0.0000018	-0.0000032
13	0.0000003	0.0	-0.0000025	-0.00000013	0.0000023	-0.0000032
14	0.0000008	-0.000003	-0.0000014	-0.00000017	0.0000004	0.0000004
15	-0.0000002	-0.000008	0.0000001	-0.00000002	0.0000001	0.0000006
16	-0.0000005	-0.000001	-0.0000004	0.00000003	0.0000001	0.0
17	0.0000004	-0.000002	-0.0000012	0.0	0.0000002	-0.0000001
18	-0.0000014	-0.000001	-0.0000002	-0.00000004	-0.0000003	0.0000004
19	0.0	0.000011	0.0000013	0.00000003	-0.0000003	0.0000001
20	0.0000018	-0.000002	0.0	0.00000003	0.0000001	-0.0000004
21	0.0	-0.000010	-0.0000006	-0.00000004	0.0000001	-0.0000001

* ASTROMETRIC POSITION, EQUATOR AND EQUINOX 1950.0

Section D: NAVIGATIONAL TABLES

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 1 THRU 20 JD 2443144.5 TO 2443164.5 DATES JAN 1 THRU JAN 20

A = 10.00000000 B = -1.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	8140.7774	8276.2232	-43.3516	0.5433
1	3609.8566	3599.0172	1.5311	0.0
2	0.0003	0.0584	0.1761	0.0
3	-0.0001	0.0040	-0.0030	0.0
4	-0.0001	0.0	-0.0001	0.0
5	0.0	-0.0001	0.0	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	4070.3884	4138.0532	-21.8520	0.2717
1	3609.8567	3599.0047	1.5402	0.0
2	0.0009	0.1168	0.3534	0.0
3	0.0004	0.0179	-0.0123	0.0
4	-0.0004	-0.0001	-0.0012	0.0
5	-0.0006	-0.0014	0.0001	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 21 THRU 40 JD 2443164.5 TO 2443184.5 DATES JAN 21 THRU FEB 9

A = 10.00000000 B = -3.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7460.2023	7553.4553	-34.6824	0.5423
1	3609.8564	3599.6220	2.7635	-0.0009
2	-0.0002	0.0854	0.1291	-0.0005
3	0.0001	0.0001	-0.0046	-0.0001
4	0.0003	-0.0006	-0.0002	0.0002
5	0.0001	0.0002	-0.0001	0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3730.1017	3776.6417	-17.4705	0.2718
1	3609.8564	3599.6229	2.7768	0.0004
2	-0.0032	0.1753	0.2598	-0.0027
3	-0.0013	-0.0043	-0.0167	-0.0046
4	0.0028	-0.0044	-0.0016	0.0017
5	0.0015	0.0036	-0.0014	0.0036

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 41 THRU 60 JD 2443184.5 TO 2443204.5 DATES FEB 10 THRU MAR 1

A = 10.00000000 B = -5.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7499.6283	7553.2246	-21.9255	0.5400
1	3609.8565	3600.2484	3.5671	0.0
2	0.0	0.0690	0.0714	0.0
3	-0.0001	-0.0020	-0.0048	0.0
4	0.0	0.0	-0.0002	0.0
5	0.0001	0.0001	-0.0002	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3749.8142	3776.5433	-11.0343	0.2700
1	3609.8571	3600.2552	3.5804	0.0
2	-0.0002	0.1383	0.1442	0.0
3	-0.0015	-0.0111	-0.0147	0.0
4	0.0002	-0.0004	-0.0014	0.0
5	0.0008	0.0024	-0.0037	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 61 THRU 80 JD 2443204.5 TO 2443224.5 DATES MAR 2 THRU MAR 21

A = 10.00000000 B = -7.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7539.0543	7555.1021	-6.8649	0.5380
1	3609.8565	3600.6571	3.9179	-0.0010
2	0.0002	0.0299	0.0172	0.0003
3	0.0001	-0.0035	-0.0047	0.0002
4	-0.0004	0.0002	-0.0001	-0.0003
5	0.0001	-0.0002	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3769.5266	3777.5214	-3.4498	0.2685
1	3609.8568	3600.6666	3.9322	-0.0019
2	0.0035	0.0583	0.0352	0.0026
3	-0.0020	-0.0097	-0.0200	0.0016
4	-0.0031	0.0014	-0.0008	-0.0020
5	0.0018	-0.0036	0.0011	-0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 81 THRU 100 JD 2443224.5 TO 2443244.5 DATES MAR 22 THRU APR 10

A = 10.00000000 B = -9.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7578.4797	7557.9622	8.7565	0.5350
1	3609.8563	3600.7403	3.8502	-0.0011
2	-0.0001	-0.0094	-0.0331	0.0
3	-0.0002	-0.0039	-0.0037	0.0004
4	0.0002	0.0	0.0	0.0
5	-0.0002	0.0003	0.0003	-0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3789.2402	3778.9906	4.4113	0.2675
1	3609.8559	3600.7534	3.8626	-0.0033
2	-0.0018	-0.0193	-0.0658	0.0
3	0.0027	-0.0208	-0.0203	0.0061
4	0.0016	0.0004	-0.0003	0.0
5	-0.0027	0.0040	0.0045	-0.0037

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 101 THRU 120 JD 2443244.5 TO 2443264.5 DATES APR 11 THRU APR 30

A = 10.00000000 B = -11.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7617.9054	7560.5166	23.3260	0.5317
1	3609.8564	3600.5085	3.3948	-0.0011
2	0.0001	-0.0438	-0.0805	0.0
3	0.0002	-0.0016	-0.0039	0.0004
4	0.0002	0.0004	0.0005	0.0
5	-0.0001	-0.0002	0.0001	-0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3808.9528	3780.3025	11.7440	0.2658
1	3609.8555	3600.5122	3.4070	-0.0033
2	-0.0010	-0.0906	-0.1648	0.0
3	0.0021	-0.0021	-0.0176	0.0061
4	0.0012	0.0031	0.0038	0.0
5	-0.0010	-0.0033	0.0014	-0.0037

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 121 THRU 140 JD 2443264.5 TO 2443284.5 DATES MAY 1 THRU MAY 20

A = 10.00000000 B = -13.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7657.3314	7561.7213	35.3363	0.5289
1	3609.8563	3600.0795	2.5736	-0.0009
2	0.0001	-0.0605	-0.1242	-0.0005
3	0.0001	-0.0001	-0.0032	-0.0001
4	0.0	0.0004	0.0001	0.0002
5	-0.0002	-0.0001	0.0002	0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3828.6656	3780.9216	17.7925	0.2652
1	3609.8551	3600.0795	2.5841	0.0004
2	0.0004	-0.1244	-0.2494	-0.0027
3	0.0038	0.0010	-0.0166	-0.0046
4	-0.0002	0.0034	0.0010	0.0017
5	-0.0028	-0.0011	0.0031	0.0036

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 141 THRU 160 JD 2443284.5 TO 2443304.5 DATES MAY 21 THRU JUNE 9

A = 10.00000000 B = -15.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7696.7574	7561.1558	43.4150	0.5267
1	3609.8566	3599.6535	1.4374	0.0
2	0.0003	-0.0424	-0.1581	0.0
3	-0.0001	0.0022	-0.0018	0.0
4	-0.0001	0.0	0.0001	0.0
5	0.0	0.0002	0.0	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3848.3784	3780.6202	21.8656	0.2633
1	3609.8567	3599.6479	1.4426	0.0
2	0.0010	-0.0845	-0.3169	0.0
3	0.0003	0.0049	-0.0062	0.0
4	-0.0005	-0.0003	0.0008	0.0
5	-0.0006	0.0032	-0.0008	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 161 THRU 180 JD 2443304.5 TO 2443324.5 DATES JUNE 10 THRU JUNE 29

A = 10.00000000 B = -17.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7736.1823	7559.3230	46.5195	0.5267
1	3609.8564	3599.4657	0.1039	0.0
2	-0.0002	0.0007	-0.1717	0.0
3	0.0001	0.0045	0.0	0.0
4	0.0003	-0.0001	0.0005	0.0
5	0.0001	-0.0002	0.0	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3868.0917	3779.6606	23.4320	0.2633
1	3609.8564	3599.4511	0.1040	0.0
2	-0.0032	0.0026	-0.3476	0.0
3	-0.0013	0.0227	-0.0006	0.0
4	0.0028	-0.0011	0.0041	0.0
5	0.0015	-0.0038	0.0005	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 181 THRU 200 JD 2443324.5 TO 2443344.5 DATES JUNE 30 THRU JULY 19

A = 10.00000000 B = -19.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7775.6084	7557.4805	44.2361	0.5267
1	3609.8565	3599.6477	-1.2359	0.0
2	0.0	0.0421	-0.1594	0.0
3	-0.0001	0.0027	0.0024	0.0
4	0.0	0.0002	0.0	0.0
5	0.0001	0.0003	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3887.8042	3778.6983	22.2774	0.2633
1	3609.8571	3599.6408	-1.2437	0.0
2	0.0002	0.0828	-0.3186	0.0
3	-0.0015	0.0057	0.0118	0.0
4	-0.0002	0.0015	-0.0002	0.0
5	0.0008	0.0041	-0.0018	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 201 THRU 220 JD 2443344.5 TO 2443364.5 DATES JULY 20 THRU AUG 8

A = 10.00000000 B = -21.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7815.0343	7556.9268	36.9298	0.5267
1	3609.8564	3600.0931	-2.3899	0.0
2	0.0002	0.0626	-0.1272	0.0
3	0.0001	-0.0002	0.0032	0.0
4	-0.0003	-0.0001	0.0	0.0
5	0.0001	0.0001	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3907.5166	3778.4007	18.5920	0.2633
1	3609.8564	3600.0940	-2.3991	0.0
2	0.0032	0.1258	-0.2539	0.0
3	-0.0013	-0.0019	0.0112	0.0
4	-0.0028	-0.0005	-0.0004	0.0
5	0.0015	0.0009	0.0012	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 221 THRU 240 JD 2443364.5 TO 2443384.5 DATES AUG 9 THRU AUG 28

A = 10.00000000 B = -23.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7854.4593	7558.2496	25.5987	0.5268
1	3609.8566	3600.5594	-3.2406	0.0002
2	-0.0003	0.0514	-0.0850	0.0002
3	-0.0001	-0.0019	0.0035	0.0002
4	0.0001	-0.0001	-0.0001	0.0002
5	0.0	0.0001	-0.0001	0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3927.2300	3779.0732	12.8843	0.2634
1	3609.8567	3600.5657	-3.2516	0.0005
2	-0.0010	0.1039	-0.1693	-0.0009
3	0.0003	-0.0099	0.0160	-0.0024
4	0.0005	-0.0010	-0.0006	0.0012
5	-0.0006	0.0017	-0.0017	0.0024

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 241 THRU 260 JD 2443384.5 TO 2443404.5 DATES AUG 29 THRU SEPT 17

A = 10.00000000 B = -25.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7893.8853	7561.1163	11.5577	0.5300
1	3609.8563	3600.8452	-3.7432	0.0
2	-0.0001	0.0173	-0.0405	0.0
3	0.0001	-0.0033	0.0038	0.0
4	0.0	0.0002	-0.0004	0.0
5	-0.0002	0.0002	-0.0002	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3946.9428	3780.5411	5.8189	0.2650
1	3609.8551	3600.8561	-3.7558	0.0
2	-0.0004	0.0331	-0.0774	0.0
3	0.0038	-0.0174	0.0201	0.0
4	0.0002	0.0014	-0.0036	0.0
5	-0.0028	0.0035	-0.0040	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 261 THRU 280 JD 2443404.5 TO 2443424.5 DATES SEPT 18 THRU OCT 7

A = 10.00000000 B = -27.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7933.3112	7564.5369	-3.7683	0.5323
1	3609.8564	3600.8321	-3.8806	0.0009
2	-0.0001	-0.0227	0.0062	-0.0005
3	0.0002	-0.0049	0.0037	0.0001
4	-0.0002	-0.0001	0.0	0.0002
5	-0.0001	0.0002	0.0	-0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3966.6556	3782.2910	-1.8904	0.2668
1	3609.8555	3600.8475	-3.8917	-0.0004
2	0.0010	-0.0447	0.0126	-0.0027
3	0.0021	-0.0229	0.0149	0.0046
4	-0.0012	-0.0007	-0.0001	0.0017
5	-0.0010	0.0028	-0.0001	-0.0036

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 281 THRU 300 JD 2443424.5 TO 2443444.5 DATES OCT 8 THRU OCT 27

A = 10.00000000 B = -29.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7252.7373	7567.2287	-18.8765	0.5353
1	3609.8566	3600.4827	-3.6304	0.0010
2	0.0003	-0.0616	0.0575	-0.0003
3	-0.0001	-0.0027	0.0046	-0.0002
4	-0.0001	0.0001	0.0001	0.0003
5	-0.0001	0.0	-0.0004	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3626.3683	3783.6760	-9.4957	0.2682
1	3609.8565	3600.4908	-3.6464	0.0019
2	0.0013	-0.1238	0.1144	-0.0026
3	0.0010	-0.0106	0.0270	-0.0016
4	-0.0007	0.0006	0.0007	0.0020
5	-0.0010	-0.0002	-0.0069	0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 301 THRU 320 JD 2443444.5 TO 2443464.5 DATES OCT 28 THRU NOV 16

A = 10.00000000 B = -31.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7292.1623	7567.9785	-32.1337	0.5383
1	3609.8564	3599.8697	-2.9520	0.0011
2	-0.0002	-0.0872	0.1126	0.0
3	0.0001	-0.0003	0.0047	-0.0004
4	0.0004	0.0004	0.0002	0.0
5	0.0001	-0.0002	-0.0002	0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3646.0817	3784.0768	-16.1793	0.2692
1	3609.8565	3599.8696	-2.9674	0.0033
2	-0.0035	-0.1776	0.2239	0.0
3	-0.0011	0.0031	0.0234	-0.0061
4	0.0031	0.0032	0.0013	0.0
5	0.0012	-0.0034	-0.0035	0.0037

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 321 THRU 340 JD 2443464.5 TO 2443484.5 DATES NOV 17 THRU DEC 6

A = 10.00000000 B = -33.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7331.5883	7566.1013	-41.8002	0.5405
1	3609.8565	3599.2017	-1.8377	0.0004
2	0.0	-0.0749	0.1645	0.0004
3	-0.0001	0.0025	0.0034	0.0003
4	0.0	0.0003	-0.0003	0.0003
5	0.0001	0.0001	-0.0002	0.0002

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3665.7942	3783.1259	-21.0650	0.2701
1	3609.8571	3599.1946	-1.8489	0.0004
2	-0.0002	-0.1524	0.3318	-0.0014
3	-0.0015	0.0088	0.0176	-0.0025
4	0.0002	0.0026	-0.0028	0.0022
5	0.0008	0.0008	-0.0031	0.0031

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 341 THRU 360 JD 2443484.5 TO 2443504.5 DATES DEC 7 THRU DEC 26

A = 10.00000000 B = -35.10000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	7371.0143	7562.0045	-46.2970	0.5433
1	3609.8564	3598.7967	-0.3868	0.0
2	0.0002	-0.0195	0.1938	0.0
3	0.0001	0.0056	0.0012	0.0
4	-0.0004	-0.0001	-0.0005	0.0
5	0.0001	0.0003	0.0004	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	3685.5066	3781.0216	-23.3428	0.2717
1	3609.8568	3598.7815	-0.3884	0.0
2	0.0035	-0.0381	0.3915	0.0
3	-0.0021	0.0160	-0.0028	0.0
4	-0.0030	-0.0008	-0.0039	0.0
5	0.0019	0.0051	0.0060	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 346 THRU 365 JD 2443489.5 TO 2443509.5 DATES DEC 12 THRU DEC 31

A = 10.00000000 B = -35.60000000

CHEBYSHEV COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	-3419.1289	-3239.1955	-46.4876	0.5433
1	3609.8564	3598.7751	0.0024	0.0
2	0.0002	-0.0024	0.1952	0.0
3	0.0001	0.0055	0.0001	0.0
4	-0.0004	-0.0002	-0.0006	0.0
5	0.0001	-0.0002	0.0	0.0

POWERS OF TIME COEFFICIENTS

	ARIES GHA	SUN GHA	SUN DEC	SUN S D
	0	0	0	0
0	-1709.5651	-1619.5956	-23.4396	0.2717
1	3609.8565	3598.7576	0.0023	0.0
2	0.0035	-0.0029	0.3956	0.0
3	-0.0011	0.0259	-0.0002	0.0
4	-0.0031	-0.0018	-0.0052	0.0
5	0.0012	-0.0031	0.0006	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 1 THRU 15 JD 2443144.5 TO 2443159.5 DATES JAN 1 THRU JAN 15

A = 7.50000000 B = -1.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	6382.6858	-21.8437	6503.5667	-47.8977	6237.5763	34.3508	6779.6881	34.1897
1	2699.7480	3.4878	2701.2194	0.1722	2707.5835	-0.0130	2707.8913	0.1674
2	0.1080	0.0492	-0.0069	0.0609	-0.0488	0.0126	0.0156	0.0040
3	-0.0005	-0.0035	0.0008	0.0003	-0.0002	-0.0001	-0.0008	-0.0002
4	-0.0003	0.0	0.0001	0.0	0.0	0.0001	0.0003	-0.0003
5	0.0003	0.0001	-0.0003	0.0	-0.0002	-0.0002	0.0001	0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	3191.2346	-10.9709	3251.7903	-24.0098	3118.8370	17.1629	3389.8287	17.0906
1	2699.7509	3.4986	2701.2158	0.1711	2707.5831	-0.0137	2707.8945	0.1687
2	0.2187	0.0979	-0.0146	0.1219	-0.0979	0.0244	0.0291	0.0103
3	-0.0075	-0.0151	0.0082	0.0018	0.0033	0.0032	-0.0059	-0.0036
4	-0.0028	0.0004	0.0009	-0.0001	0.0004	0.0007	0.0021	-0.0024
5	0.0043	0.0008	-0.0042	-0.0003	-0.0033	-0.0027	0.0020	0.0024

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 16 THRU 30 JD 2443159.5 TO 2443174.5 DATES JAN 16 THRU JAN 30

A = 7.50000000 B = -3.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5663.4091	-7.3998	5788.4205	-46.2333	5547.1275	34.4987	6091.4515	34.9038
1	2700.6183	3.6956	2701.2182	0.6584	2707.1927	0.0869	2707.9828	0.1873
2	0.1134	0.0028	0.0060	0.0599	-0.0479	0.0124	0.0068	0.0009
3	0.0019	-0.0039	0.0011	-0.0001	0.0003	-0.0004	-0.0006	-0.0007
4	0.0003	0.0004	-0.0003	0.0	0.0003	0.0	0.0	0.0001
5	0.0003	0.0	0.0002	-0.0001	-0.0002	0.0001	0.0002	-0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2831.5914	-3.7022	2894.2040	-23.1766	2773.6120	17.2370	3045.7190	17.4511
1	2700.6137	3.7073	2701.2161	0.6584	2707.1910	0.0887	2707.9856	0.1885
2	0.2248	0.0021	0.0142	0.1199	-0.0983	0.0249	0.0133	0.0012
3	0.0026	-0.0158	-0.0001	0.0009	0.0044	-0.0043	-0.0064	0.0006
4	0.0021	0.0034	-0.0023	-0.0001	0.0025	-0.0001	0.0002	0.0007
5	0.0041	0.0003	0.0035	-0.0011	-0.0025	0.0022	0.0033	-0.0026

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 31 THRU 45 JD 2443174.5 TO 2443189.5 DATES JAN 31 THRU FEB 14

A = 7.50000000 B = -5.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5667.8983	7.1217	5793.4600	-42.6681	5575.1557	35.0286	6123.4328	35.6502
1	2701.6584	3.5247	2701.3092	1.1199	2706.8247	0.1769	2707.9992	0.1839
2	0.1525	-0.0458	0.0159	0.0549	-0.0436	0.0106	-0.0029	-0.0019
3	0.0055	-0.0042	0.0007	-0.0005	0.0002	-0.0002	-0.0008	-0.0003
4	0.0005	-0.0004	0.0	0.0	-0.0002	0.0002	-0.0001	-0.0003
5	-0.0003	-0.0001	0.0003	-0.0006	0.0003	0.0002	-0.0003	-0.0003

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2833.7972	3.6062	2896.7140	-21.3889	2787.6213	17.5039	3061.7192	17.8267
1	2701.6404	3.5369	2701.3086	1.1186	2706.8255	0.1784	2708.0004	0.1833
2	0.3008	-0.0886	0.0322	0.1097	-0.0858	0.0197	-0.0052	-0.0017
3	0.0279	-0.0153	-0.0033	0.0091	-0.0048	-0.0044	0.0018	0.0044
4	0.0042	-0.0030	-0.0003	0.0	-0.0014	0.0016	-0.0005	-0.0021
5	-0.0047	-0.0012	0.0050	-0.0088	0.0045	0.0029	-0.0041	-0.0044

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 46 THRU 60 JD 2443189.5 TO 2443204.5 DATES FEB 15 THRU MAR 1

A = 7.50000000 B = -7.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5677.5398	20.1348	5798.9955	-37.3631	5601.7952	35.8829	6155.3232	36.3380
1	2703.2519	2.9317	2701.4633	1.5258	2706.4998	0.2475	2707.9385	0.1583
2	0.2605	-0.1068	0.0222	0.0461	-0.0376	0.0074	-0.0124	-0.0043
3	0.0135	-0.0065	0.0	-0.0008	0.0005	-0.0002	-0.0008	-0.0005
4	0.0005	-0.0004	0.0002	0.0	0.0	0.0	-0.0001	0.0002
5	0.0	-0.0002	0.0004	0.0002	-0.0002	0.0	-0.0002	0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2838.5099	10.1739	2899.4758	-18.7276	2800.9352	17.9340	3077.6739	18.1734
1	2703.2113	2.9500	2701.4653	1.5289	2706.4972	0.2481	2707.9399	0.1611
2	0.5170	-0.2104	0.0425	0.0921	-0.0755	0.0149	-0.0237	-0.0100
3	0.0547	-0.0215	-0.0079	-0.0061	0.0062	-0.0009	0.0012	-0.0069
4	0.0041	-0.0033	0.0019	0.0	0.0003	-0.0001	-0.0012	0.0015
5	-0.0006	-0.0035	0.0064	0.0024	-0.0034	0.0001	-0.0036	0.0037

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 61 THRU 75 JD 2443204.5 TO 2443219.5 DATES MAR 2 THRU MAR 16

A = 7.50000000 B = -9.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5695.8854	29.5469	5805.2115	-30.5810	5627.2330	36.9759	5466.8294	36.8896
1	2706.0794	1.6848	2701.6454	1.8565	2706.2254	0.2962	2707.8088	0.1159
2	0.4484	-0.2144	0.0226	0.0361	-0.0309	0.0046	-0.0195	-0.0056
3	0.0146	-0.0116	-0.0002	-0.0007	0.0003	0.0	-0.0004	0.0001
4	-0.0004	-0.0005	0.0	0.0001	-0.0001	-0.0002	-0.0001	-0.0002
5	-0.0002	0.0001	0.0001	-0.0001	0.0	0.0001	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2847.4939	14.9873	2902.5832	-15.3265	2813.6473	18.4831	2733.4340	18.4503
1	2706.0347	1.7199	2701.6466	1.8581	2706.2244	0.2968	2707.8106	0.1156
2	0.8998	-0.4245	0.0450	0.0710	-0.0607	0.0108	-0.0378	-0.0099
3	0.0617	-0.0477	-0.0030	-0.0008	0.0015	-0.0021	-0.0041	0.0006
4	-0.0030	-0.0043	0.0001	0.0011	-0.0011	-0.0016	-0.0011	-0.0014
5	-0.0026	0.0012	0.0018	-0.0017	-0.0002	0.0016	0.0021	-0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 76 THRU 90 JD 2443219.5 TO 2443234.5 DATES MAR 17 THRU MAR 31

A = 7.50000000 B = -11.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5727.8900	31.9374	5812.1452	-22.6497	5651.6760	38.2197	5497.7193	37.2516
1	2709.9222	-0.6024	2701.8196	2.0995	2706.0011	0.3231	2707.6324	0.0645
2	0.4388	-0.3455	0.0210	0.0245	-0.0251	0.0020	-0.0243	-0.0069
3	-0.0274	-0.0037	-0.0002	-0.0008	0.0006	-0.0004	-0.0002	-0.0001
4	-0.0044	0.0022	-0.0003	0.0002	0.0	0.0002	-0.0002	-0.0001
5	-0.0002	0.0001	-0.0001	-0.0001	0.0001	0.0002	0.0001	-0.0003

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2863.5017	16.3164	2906.0512	-11.3492	2825.8631	19.1081	2748.8838	18.6326
1	2710.0036	-0.5905	2701.8200	2.1015	2706.0000	0.3251	2707.6337	0.0634
2	0.9130	-0.7088	0.0446	0.0472	-0.0498	0.0024	-0.0470	-0.0130
3	-0.1058	-0.0176	0.0007	-0.0013	-0.0001	-0.0047	-0.0036	0.0052
4	-0.0353	0.0179	-0.0025	0.0019	-0.0004	0.0015	-0.0016	-0.0007
5	-0.0032	0.0021	-0.0013	-0.0015	0.0019	0.0025	0.0022	-0.0045

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 91 THRU 105 JD 2443234.5 TO 2443249.5 DATES APR 1 THRU APR 15

A = 7.50000000 B = -13.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5771.0351	24.8465	5819.7219	-13.9297	5675.3199	39.5275	5527.8474	37.3981
1	2711.1009	-2.7447	2701.9633	2.2511	2705.8256	0.3294	2707.4304	0.0083
2	-0.2044	-0.1098	0.0146	0.0133	-0.0191	-0.0005	-0.0260	-0.0069
3	-0.0581	0.0392	-0.0004	-0.0007	0.0	-0.0002	0.0003	0.0003
4	0.0034	0.0004	-0.0001	0.0001	0.0001	-0.0001	-0.0003	0.0
5	0.0004	-0.0004	-0.0001	-0.0001	0.0001	-0.0002	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2885.7254	12.5334	2909.8463	-6.9780	2837.6791	19.7643	2763.9494	18.7059
1	2711.2776	-2.8641	2701.9640	2.2529	2705.8262	0.3290	2707.4299	0.0072
2	-0.4362	-0.2227	0.0297	0.0254	-0.0391	-0.0007	-0.0500	-0.0135
3	-0.2415	0.1640	-0.0001	-0.0013	-0.0024	0.0035	-0.0001	0.0018
4	0.0273	0.0031	-0.0005	0.0012	0.0010	-0.0004	-0.0020	-0.0003
5	0.0072	-0.0058	-0.0011	-0.0014	0.0020	-0.0036	0.0009	-0.0004

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 106 THRU 120 JD 2443249.5 TO 2443264.5 DATES APR 16 THRU APR 30

A = 7.50000000 B = -15.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5809.3149	14.6862	5827.7834	-4.7876	5698.3465	40.8235	5557.1559	37.3206
1	2707.7868	-2.0483	2702.0627	2.3107	2705.6926	0.3172	2707.2248	-0.0468
2	-0.5100	0.2299	0.0096	0.0019	-0.0140	-0.0024	-0.0248	-0.0066
3	0.0041	0.0105	-0.0005	-0.0009	0.0006	0.0002	-0.0003	0.0002
4	0.0024	-0.0024	-0.0002	0.0002	0.0001	0.0002	-0.0001	0.0001
5	-0.0001	0.0	-0.0002	0.0	-0.0006	-0.0001	0.0	-0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2905.1698	7.1108	2913.8818	-2.3955	2849.1873	20.4143	2778.6027	18.6670
1	2707.7738	-2.0796	2702.0634	2.3132	2705.6881	0.3163	2707.2259	-0.0482
2	-1.0391	0.4790	0.0212	0.0019	-0.0284	-0.0060	-0.0492	-0.0143
3	0.0190	0.0411	0.0012	-0.0027	0.0139	0.0021	-0.0021	0.0040
4	0.0191	-0.0192	-0.0019	0.0020	0.0004	0.0013	-0.0005	0.0011
5	-0.0020	0.0007	-0.0025	-0.0008	-0.0094	-0.0010	0.0008	-0.0025

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 121 THRU 135 JD 2443264.5 TO 2443279.5 DATES MAY 1 THRU MAY 15

A = 7.50000000 B = -17.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5833.1416	10.3645	5836.1436	4.4164	5720.9238	42.0448	5585.6653	37.0263
1	2704.2643	-0.1245	2702.1118	2.2821	2705.6002	0.2918	2707.0313	-0.0995
2	-0.3499	0.2195	0.0032	-0.0087	-0.0093	-0.0038	-0.0228	-0.0063
3	0.0164	-0.0077	-0.0004	-0.0009	0.0002	-0.0001	0.0003	-0.0001
4	-0.0001	-0.0002	-0.0004	-0.0002	0.0001	-0.0002	0.0	0.0001
5	0.0	0.0002	-0.0001	-0.0003	0.0002	0.0003	0.0001	0.0004

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2916.9206	4.9626	2918.0683	2.2167	2860.4714	21.0260	2792.8554	18.5195
1	2704.2154	-0.1004	2702.1122	2.2833	2705.6004	0.2935	2707.0310	-0.0975
2	-0.6989	0.4405	0.0092	-0.0158	-0.0198	-0.0058	-0.0458	-0.0130
3	0.0646	-0.0342	0.0014	0.0028	-0.0027	-0.0062	-0.0013	-0.0076
4	-0.0009	-0.0016	-0.0028	-0.0017	0.0011	-0.0019	0.0002	0.0005
5	0.0007	0.0026	-0.0023	-0.0052	0.0028	0.0046	0.0020	0.0059

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 136 THRU 150 JD 2443279.5 TO 2443294.5 DATES MAY 16 THRU MAY 30

A = 7.50000000 B = -19.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5845.6937	12.7726	5844.6065	13.3391	5743.2067	43.1424	5613.4426	36.5322
1	2702.1420	1.2482	2702.1161	2.1711	2705.5452	0.2557	2706.8598	-0.1475
2	-0.1947	0.1246	-0.0016	-0.0187	-0.0044	-0.0052	-0.0197	-0.0056
3	0.0087	-0.0071	-0.0007	-0.0010	0.0005	-0.0005	0.0004	0.0002
4	-0.0006	-0.0002	-0.0003	-0.0001	0.0004	-0.0001	0.0005	0.0002
5	-0.0001	-0.0001	-0.0003	-0.0001	0.0001	0.0001	-0.0002	-0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2923.0410	6.2615	2922.3045	6.6882	2871.6081	21.5763	2806.7415	18.2719
1	2702.1156	1.2691	2702.1165	2.1734	2705.5442	0.2574	2706.8578	-0.1489
2	-0.3845	0.2508	-0.0006	-0.0365	-0.0117	-0.0096	-0.0433	-0.0130
3	0.0361	-0.0269	0.0039	-0.0012	0.0005	-0.0033	0.0048	0.0044
4	-0.0049	-0.0016	-0.0026	-0.0010	0.0029	-0.0007	0.0040	0.0019
5	-0.0011	-0.0012	-0.0053	-0.0023	0.0011	0.0011	-0.0026	-0.0030

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 151 THRU 165 JD 2443294.5 TO 2443309.5 DATES MAY 31 THRU JUNE 14

A = 7.50000000 B = -21.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5851.6354	19.2551	5853.0165	21.6637	5765.3424	44.0790	5640.5893	35.8551
1	2700.8835	1.9294	2702.0858	1.9838	2705.5263	0.2124	2706.7170	-0.1907
2	-0.1285	0.0488	-0.0058	-0.0279	0.0002	-0.0059	-0.0160	-0.0049
3	0.0037	-0.0053	0.0	-0.0002	0.0003	0.0002	0.0003	-0.0001
4	-0.0003	-0.0002	-0.0002	-0.0001	0.0004	-0.0001	0.0001	0.0
5	0.0002	0.0002	0.0003	0.0	0.0001	-0.0002	-0.0001	0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2925.9459	9.5786	2926.5138	10.8596	2882.6713	22.0453	2820.3108	17.9325
1	2700.8734	1.9463	2702.0872	1.9845	2705.5262	0.2110	2706.7155	-0.1900
2	-0.2544	0.0989	-0.0098	-0.0547	-0.0024	-0.0108	-0.0330	-0.0099
3	0.0107	-0.0253	-0.0055	-0.0007	-0.0016	0.0039	0.0034	-0.0017
4	-0.0026	-0.0014	-0.0017	-0.0012	0.0028	-0.0010	0.0010	0.0
5	0.0034	0.0033	0.0044	-0.0002	0.0021	-0.0024	-0.0018	0.0010

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 166 THRU 180 JD 2443309.5 TO 2443324.5 DATES JUNE 15 THRU JUNE 29

A = 7.50000000 B = -23.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5853.3286	27.3452	5861.2661	29.1049	5787.4767	44.8343	5667.2252	35.0185
1	2699.9862	2.0647	2702.0394	1.7302	2705.5445	0.1649	2706.6038	-0.2267
2	-0.1006	-0.0128	-0.0055	-0.0353	0.0048	-0.0058	-0.0121	-0.0040
3	0.0010	-0.0044	-0.0001	-0.0003	0.0004	-0.0003	0.0005	0.0003
4	-0.0001	0.0001	0.0002	-0.0001	0.0001	-0.0002	0.0002	0.0
5	-0.0001	-0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	-0.0003

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2926.7649	13.6855	2930.6387	14.5877	2893.7337	22.4227	2833.6250	17.5133
1	2699.9825	2.0772	2702.0404	1.7317	2705.5443	0.1667	2706.6028	-0.2288
2	-0.2007	-0.0267	-0.0123	-0.0702	0.0086	-0.0099	-0.0261	-0.0083
3	0.0065	-0.0152	-0.0028	-0.0032	-0.0028	-0.0046	0.0002	0.0065
4	-0.0006	0.0012	0.0013	-0.0005	0.0010	-0.0016	0.0018	0.0002
5	-0.0020	-0.0018	0.0018	0.0016	0.0036	0.0027	0.0014	-0.0043

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 181 THRU 195 JD 2443324.5 TO 2443339.5 DATES JUNE 30 THRU JULY 14

A = 7.50000000 B = -25.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5851.7212	35.0770	5869.3412	35.4198	5809.7574	45.3987	5693.4686	34.0509
1	2699.2184	1.7589	2701.9993	1.4223	2705.5996	0.1175	2706.5212	-0.2567
2	-0.0902	-0.0633	-0.0037	-0.0410	0.0093	-0.0054	-0.0085	-0.0035
3	0.0012	-0.0037	-0.0002	-0.0003	0.0004	0.0002	0.0001	0.0003
4	-0.0003	0.0	0.0	-0.0001	0.0	0.0003	0.0002	-0.0003
5	0.0	0.0002	0.0002	0.0002	-0.0004	0.0001	-0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2925.9506	17.6018	2934.6743	17.7507	2904.8694	22.7051	2846.7429	17.0286
1	2699.2152	1.7709	2702.0009	1.4243	2705.5966	0.1175	2706.5195	-0.2573
2	-0.1785	-0.1265	-0.0073	-0.0811	0.0185	-0.0133	-0.0183	-0.0044
3	0.0037	-0.0187	-0.0051	-0.0058	0.0091	-0.0015	0.0063	-0.0002
4	-0.0020	-0.0001	-0.0002	-0.0008	0.0001	0.0024	0.0014	-0.0025
5	0.0008	0.0033	0.0036	0.0037	-0.0062	0.0018	-0.0048	0.0012

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 196 THRU 210 JD 2443339.5 TO 2443354.5 DATES JULY 15 THRU JULY 29

A = 7.50000000 B = -27.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5847.2738	40.8267	5877.3190	40.4272	5832.3386	45.7773	5719.4435	32.9774
1	2698.5763	1.0815	2701.9957	1.0778	2705.6951	0.0722	2706.4690	-0.2790
2	-0.0690	-0.1048	0.0029	-0.0443	0.0147	-0.0051	-0.0048	-0.0024
3	0.0020	-0.0029	0.0006	-0.0001	0.0003	0.0	0.0004	0.0001
4	0.0002	0.0	-0.0001	-0.0002	0.0003	0.0002	-0.0002	0.0002
5	0.0001	0.0002	-0.0003	0.0	0.0	0.0001	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2923.7062	20.5181	2938.6564	20.2577	2916.1549	22.8939	2859.7263	16.4914
1	2698.5707	1.0914	2701.9927	1.0783	2705.6941	0.0725	2706.4682	-0.2794
2	-0.1400	-0.2094	0.0069	-0.0867	0.0272	-0.0117	-0.0081	-0.0067
3	0.0061	-0.0163	0.0074	-0.0008	0.0016	-0.0015	0.0004	0.0006
4	0.0019	-0.0002	-0.0010	-0.0019	0.0022	0.0014	-0.0014	0.0018
5	0.0017	0.0038	-0.0040	0.0002	-0.0003	0.0012	0.0009	-0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 211 THRU 225 JD 2443354.5 TO 2443369.5 DATES JULY 30 THRU AUG 13

A = 7.50000000 B = -29.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5840.6654	43.2906	5885.3931	44.0168	5855.3869	45.9888	5745.2665	31.8325
1	2698.1476	0.1282	2702.0483	0.7163	2705.8338	0.0339	2706.4459	-0.2930
2	-0.0354	-0.1310	0.0111	-0.0454	0.0205	-0.0043	-0.0010	-0.0013
3	0.0037	-0.0012	0.0010	-0.0001	0.0005	0.0	0.0003	-0.0003
4	0.0001	0.0003	-0.0002	0.0	0.0001	-0.0001	0.0001	-0.0001
5	0.0001	-0.0002	-0.0001	0.0002	0.0001	-0.0002	0.0001	-0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2920.3682	21.7766	2942.6852	22.0539	2927.6730	22.9987	2872.6344	15.9174
1	2698.1369	0.1305	2702.0448	0.7174	2705.8326	0.0328	2706.4455	-0.2924
2	-0.0716	-0.2642	0.0238	-0.0912	0.0403	-0.0081	-0.0031	-0.0017
3	0.0131	0.0	0.0055	-0.0038	0.0010	0.0048	-0.0011	0.0001
4	0.0009	0.0022	-0.0016	0.0003	0.0006	-0.0006	0.0010	-0.0009
5	0.0015	-0.0038	-0.0011	0.0027	0.0008	-0.0039	0.0019	-0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 226 THRU 240 JD 2443369.5 TO 2443384.5 DATES AUG 14 THRU AUG 28

A = 7.50000000 B = -31.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5832.9624	41.6495	5893.8413	46.1720	5879.0842	46.0633	5771.0549	30.6500
1	2698.0362	-0.9529	2702.1858	0.3635	2706.0200	0.0045	2706.4514	-0.2971
2	0.0062	-0.1362	0.0228	-0.0425	0.0264	-0.0028	0.0024	0.0
3	0.0031	0.0004	0.0010	0.0005	-0.0001	0.0002	0.0003	0.0002
4	0.0002	0.0002	0.0	0.0	-0.0002	-0.0004	-0.0001	0.0
5	0.0002	-0.0002	0.0	-0.0004	0.0001	0.0	0.0	0.0005

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2916.4752	20.9611	2946.8979	23.1286	2939.5155	23.0341	2885.5249	15.3250
1	2698.0282	-0.9550	2702.1825	0.3601	2706.0210	0.0039	2706.4503	-0.2955
2	0.0109	-0.2741	0.0454	-0.0855	0.0542	-0.0025	0.0059	0.0
3	0.0073	0.0054	0.0051	0.0101	-0.0028	0.0009	0.0018	-0.0082
4	0.0015	0.0018	0.0001	0.0004	-0.0013	-0.0031	-0.0011	0.0
5	0.0040	-0.0032	-0.0007	-0.0066	0.0018	0.0	-0.0004	0.0073

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 241 THRU 255 JD 2443384.5 TO 2443399.5 DATES AUG 29 THRU SEPT 12

A = 7.50000000 B = -33.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5825.4007	35.7395	5903.0147	46.9782	5903.6294	46.0424	5796.9254	29.4704
1	2698.2054	-1.9888	2702.4108	0.0448	2706.2581	-0.0138	2706.4864	-0.2914
2	0.0331	-0.1198	0.0344	-0.0367	0.0334	-0.0019	0.0058	0.0016
3	0.0015	0.0020	0.0013	0.0004	0.0007	0.0	0.0003	-0.0001
4	-0.0002	0.0002	0.0	-0.0002	-0.0002	0.0007	-0.0001	0.0
5	0.0001	0.0001	-0.0001	-0.0001	0.0	0.0002	-0.0001	0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2912.6671	17.9897	2951.4729	23.5256	2951.7812	23.0237	2898.4568	14.7336
1	2698.2011	-1.9944	2702.4063	0.0434	2706.2562	-0.0130	2706.4851	-0.2902
2	0.0678	-0.2409	0.0687	-0.0719	0.0680	-0.0091	0.0123	0.0035
3	0.0050	0.0063	0.0077	0.0030	0.0019	-0.0036	0.0033	-0.0042
4	-0.0016	0.0013	0.0002	-0.0014	-0.0013	0.0053	-0.0006	-0.0002
5	0.0009	0.0014	-0.0019	-0.0012	0.0007	0.0030	-0.0017	0.0030

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 256 THRU 270 JD 2443399.5 TO 2443414.5 DATES SEPT 13 THRU SEPT 27

A = 7.50000000 B = -35.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5818.8227	26.0489	5913.2934	46.6198	5929.2358	45.9727	5822.9929	28.3371
1	2698.5104	-2.8302	2702.7393	-0.2164	2706.5512	-0.0200	2706.5503	-0.2738
2	0.0390	-0.0888	0.0471	-0.0281	0.0402	0.0001	0.0092	0.0031
3	-0.0007	0.0033	0.0010	0.0012	0.0009	0.0	0.0004	0.0004
4	-0.0004	0.0001	0.0001	-0.0002	-0.0001	-0.0004	-0.0001	0.0
5	0.0	0.0	0.0002	0.0	-0.0003	0.0001	0.0003	0.0004

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2909.3720	13.1134	2956.5997	23.3378	2964.5776	22.9858	2911.4871	14.1654
1	2698.5125	-2.8402	2702.7376	-0.2201	2706.5468	-0.0196	2706.5503	-0.2730
2	0.0811	-0.1785	0.0931	-0.0544	0.0814	0.0035	0.0194	0.0063
3	-0.0024	0.0130	-0.0009	0.0056	0.0104	-0.0015	-0.0035	-0.0061
4	-0.0032	0.0008	0.0011	-0.0018	-0.0010	-0.0033	-0.0009	-0.0001
5	-0.0005	0.0003	0.0038	-0.0007	-0.0056	0.0012	0.0041	0.0061

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 271 THRU 285 JD 2443414.5 TO 2443429.5 DATES SEPT 28 THRU OCT 12

A = 7.50000000 B = -37.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5813.3960	13.5459	5925.0818	45.3776	5956.1206	45.9041	5849.3742	27.2983
1	2698.7615	-3.3894	2703.1656	-0.3955	2706.8968	-0.0125	2706.6434	-0.2438
2	0.0216	-0.0506	0.0604	-0.0163	0.0462	0.0017	0.0134	0.0043
3	-0.0021	0.0037	0.0013	0.0009	0.0004	0.0	0.0001	0.0
4	-0.0002	0.0001	0.0	-0.0002	-0.0002	0.0	0.0	0.0002
5	-0.0002	-0.0001	-0.0003	0.0	-0.0001	0.0003	0.0003	-0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2906.6762	6.8237	2962.4805	22.7049	2978.0140	22.9503	2924.6737	13.6451
1	2698.7668	-3.4008	2703.1604	-0.3982	2706.8950	-0.0113	2706.6442	-0.2442
2	0.0446	-0.1022	0.1208	-0.0308	0.0937	0.0037	0.0265	0.0067
3	-0.0045	0.0159	0.0110	0.0032	0.0040	-0.0051	-0.0046	0.0019
4	-0.0014	0.0010	0.0	-0.0018	-0.0013	-0.0003	0.0004	0.0020
5	-0.0032	-0.0008	-0.0047	0.0005	-0.0020	0.0042	0.0041	-0.0016

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 286 THRU 300 JD 2443429.5 TO 2443444.5 DATES OCT 13 THRU OCT 27

A = 7.50000000 B = -39.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5808.6173	-0.5560	5938.8180	43.6206	5984.4792	45.8834	5876.1882	26.4054
1	2698.8264	-3.6267	2703.7161	-0.4719	2707.2857	0.0027	2706.7664	-0.2012
2	-0.0065	-0.0084	0.0769	-0.0030	0.0505	0.0026	0.0174	0.0061
3	-0.0032	0.0032	0.0012	0.0012	0.0006	-0.0003	0.0004	-0.0001
4	-0.0001	-0.0001	-0.0002	-0.0001	-0.0001	-0.0001	-0.0002	0.0
5	0.0001	0.0002	0.0002	0.0003	0.0001	0.0002	0.0001	-0.0003

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2904.3150	-0.2697	2969.3320	21.8132	2992.1890	22.9391	2938.0765	13.1966
1	2698.8366	-3.6354	2703.7137	-0.4744	2707.2845	0.0045	2706.7656	-0.2025
2	-0.0119	-0.0161	0.1549	-0.0053	0.1015	0.0057	0.0362	0.0121
3	-0.0151	0.0092	0.0001	-0.0002	0.0005	-0.0045	-0.0004	0.0060
4	-0.0011	-0.0007	-0.0012	-0.0007	-0.0005	-0.0006	-0.0015	0.0
5	0.0019	0.0028	0.0037	0.0041	0.0014	0.0025	0.0017	-0.0051

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 301 THRU 315 JD 2443444.5 TO 2443459.5 DATES OCT 28 THRU NOV 11

A = 7.50000000 B = -41.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5803.6021	-14.9243	5955.0308	41.7963	6014.4350	45.9311	5903.5518	25.7069
1	2698.6384	-3.5206	2704.4089	-0.4261	2707.6921	0.0214	2706.9176	-0.1462
2	-0.0398	0.0356	0.0989	0.0143	0.0503	0.0023	0.0207	0.0077
3	-0.0028	0.0035	0.0027	0.0018	0.0001	0.0	0.0001	0.0004
4	0.0	0.0	0.0003	-0.0001	-0.0002	0.0	-0.0002	-0.0001
5	-0.0003	0.0001	-0.0001	-0.0001	-0.0001	0.0	0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2901.8409	-7.4978	2977.4167	20.8838	3007.1671	22.9632	2951.7550	12.8456
1	2698.6453	-3.5305	2704.4003	-0.4319	2707.6912	0.0214	2706.9187	-0.1467
2	-0.0797	0.0716	0.1958	0.0291	0.1020	0.0048	0.0432	0.0162
3	-0.0054	0.0118	0.0125	0.0092	0.0023	-0.0003	-0.0053	-0.0013
4	0.0	-0.0003	0.0020	-0.0005	-0.0015	-0.0003	-0.0018	-0.0007
5	-0.0046	0.0016	-0.0013	-0.0017	-0.0015	0.0004	0.0045	0.0023

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 316 THRU 330 JD 2443459.5 TO 2443474.5 DATES NOV 12 THRU NOV 26

A = 7.50000000 B = -43.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5797.3544	-28.1429	5974.4360	40.4356	6045.9704	46.0449	5931.5701	25.2508
1	2698.2176	-3.0503	2705.3180	-0.2395	2708.0695	0.0349	2707.0938	-0.0804
2	-0.0641	0.0819	0.1289	0.0325	0.0431	0.0009	0.0234	0.0086
3	-0.0014	0.0041	0.0030	0.0016	-0.0010	-0.0001	0.0005	-0.0003
4	-0.0001	0.0001	0.0002	0.0	0.0002	0.0	0.0002	-0.0001
5	0.0003	0.0002	0.0	-0.0002	0.0	0.0002	0.0	-0.0001

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2898.7412	-14.1533	2987.0893	20.1852	3022.9423	23.0215	2965.7619	12.6166
1	2698.2232	-3.0615	2705.3092	-0.2453	2708.0725	0.0362	2707.0922	-0.0803
2	-0.1273	0.1630	0.2565	0.0652	0.0847	0.0019	0.0452	0.0183
3	-0.0109	0.0122	0.0118	0.0103	-0.0036	-0.0042	0.0023	0.0017
4	-0.0009	0.0009	0.0012	-0.0002	0.0015	0.0	0.0017	-0.0011
5	0.0042	0.0034	0.0	-0.0031	-0.0004	0.0030	-0.0001	-0.0023

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 331 THRU 345 JD 2443474.5 TO 2443489.5 DATES NOV 27 THRU DEC 11

A = 7.50000000 B = -45.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5789.1398	-38.7374	5998.0099	40.1102	6078.8480	46.1924	5960.3323	25.0724
1	2697.6716	-2.2090	2706.5024	0.0910	2708.3566	0.0374	2707.2883	-0.0079
2	-0.0678	0.1276	0.1694	0.0493	0.0274	-0.0003	0.0246	0.0092
3	0.0009	0.0035	0.0034	0.0014	-0.0016	-0.0001	0.0002	-0.0001
4	0.0004	0.0	-0.0004	-0.0003	0.0001	-0.0001	0.0003	0.0
5	0.0	0.0	-0.0001	-0.0001	0.0	0.0001	0.0	0.0

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2894.6381	-19.4963	2998.8351	20.0055	3039.3967	23.0964	2980.1418	12.5270
1	2697.6689	-2.2196	2706.4914	0.0864	2708.3616	0.0381	2707.2878	-0.0077
2	-0.1388	0.2553	0.3423	0.1012	0.0538	0.0003	0.0468	0.0186
3	0.0033	0.0144	0.0162	0.0074	-0.0070	-0.0017	0.0007	0.0003
4	0.0031	-0.0002	-0.0034	-0.0025	0.0010	-0.0009	0.0024	-0.0002
5	0.0003	-0.0002	-0.0020	-0.0015	0.0004	0.0010	0.0	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 346 THRU 360 JD 2443489.5 TO 2443504.5 DATES DEC 12 THRU DEC 26

A = 7.50000000 B = -47.13333333

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	5778.8829	-45.3014	6026.9542	41.3079	6112.5790	46.3280	5989.8863	25.1877
1	2697.2241	-1.0446	2707.9947	0.5102	2708.4905	0.0291	2707.4884	0.0657
2	-0.0391	0.1612	0.1993	0.0519	0.0056	-0.0017	0.0248	0.0091
3	0.0038	0.0021	0.0010	-0.0008	-0.0018	0.0	0.0002	0.0002
4	0.0002	0.0	-0.0006	0.0002	-0.0003	0.0001	0.0005	-0.0001
5	0.0	-0.0001	-0.0001	-0.0001	-0.0002	-0.0003	0.0001	0.0002

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	2889.4808	-22.8118	3013.2772	20.6022	3056.2836	23.1659	2994.9189	12.5847
1	2697.2126	-1.0516	2707.9912	0.5119	2708.4948	0.0273	2707.4881	0.0660
2	-0.0801	0.3221	0.4031	0.1026	0.0135	-0.0043	0.0455	0.0189
3	0.0156	0.0108	0.0053	-0.0008	-0.0029	0.0070	-0.0004	-0.0024
4	0.0020	0.0003	-0.0044	0.0012	-0.0023	0.0008	0.0040	-0.0007
5	-0.0004	-0.0018	-0.0009	-0.0019	-0.0034	-0.0055	0.0009	0.0024

C HEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 351 THRU 365 JD 2443494.5 TO 2443509.5 DATES DEC 17 THRU DEC 31

A = 7.50000000 B = -47.80000000

CHEBYSHEV COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	-1424.8626	-46.3972	-1162.0307	42.0721	-1076.1043	46.3636	-1200.0855	25.2909
1	2697.1415	-0.6059	2708.5264	0.6412	2708.4939	0.0249	2707.5538	0.0894
2	-0.0230	0.1677	0.1999	0.0463	-0.0028	-0.0017	0.0245	0.0083
3	0.0042	0.0010	-0.0006	-0.0019	-0.0020	0.0001	-0.0003	0.0001
4	-0.0001	-0.0004	-0.0001	-0.0003	0.0002	0.0001	0.0002	0.0002
5	0.0002	0.0001	-0.0002	-0.0002	0.0	-0.0002	-0.0002	-0.0005

POWERS OF TIME COEFFICIENTS

	VENUS GHA	VENUS DEC	MARS GHA	MARS DEC	JUPITER GHA	JUPITER DEC	SATURN GHA	SATURN DEC
	0	0	0	0	0	0	0	0
0	-712.4084	-23.3667	-581.2154	20.9895	-538.0492	23.1837	-600.0670	12.6374
1	2697.1298	-0.6085	2708.5274	0.6459	2708.4998	0.0237	2707.5537	0.0870
2	-0.0452	0.3386	0.4010	0.0946	-0.0069	-0.0046	0.0474	0.0145
3	0.0128	0.0026	0.0009	-0.0031	-0.0078	0.0038	0.0026	0.0093
4	-0.0008	-0.0033	-0.0011	-0.0020	0.0013	0.0011	0.0015	0.0020
5	0.0033	0.0011	-0.0026	-0.0037	-0.0001	-0.0026	-0.0030	-0.0073

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 1 THRU 6 JD 2443144.5 TO 2443150.5 DATES JAN 1 THRU JAN 6

A = 3.00000000 B = -1.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2914.1170	34.4880	1.8361	0.5003
1	1044.3768	-0.9015	0.0181	0.0049
2	-0.3294	-1.9766	0.0024	0.0006
3	0.1175	-0.0228	-0.0007	-0.0002
4	0.0058	0.0201	0.0002	0.0001
5	-0.0042	0.0014	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1457.3937	19.2406	0.9159	0.2496
1	1044.0035	-0.8263	0.0196	0.0054
2	-0.7048	-4.1138	0.0031	0.0008
3	0.5532	-0.1186	-0.0002	-0.0001
4	0.0460	0.1606	0.0016	0.0004
5	-0.0665	0.0218	-0.0022	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 7 THRU 12 JD 2443150.5 TO 2443156.5 DATES JAN 7 THRU JAN 12

A = 3.00000000 B = -3.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2771.1533	5.2120	1.9228	0.5239
1	1044.2548	-12.4290	0.0232	0.0063
2	-0.2276	-0.4433	-0.0005	-0.0001
3	-0.1460	0.2365	-0.0001	0.0
4	-0.0118	0.0083	-0.0002	-0.0001
5	0.0032	0.0	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1385.7924	3.0576	0.9616	0.2620
1	1044.7089	-13.1384	0.0235	0.0064
2	-0.3606	-0.9530	0.0007	0.0002
3	-0.6486	0.9458	-0.0001	0.0
4	-0.0945	0.0663	-0.0017	-0.0005
5	0.0518	0.0002	-0.0003	-0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 13 THRU 18 JD 2443156.5 TO 2443162.5 DATES JAN 13 THRU JAN 18

A = 3.00000000 B = -5.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2616.7688	-31.8846	1.9821	0.5401
1	1038.2000	-3.5601	0.0020	0.0006
2	-0.5117	2.5255	-0.0058	-0.0016
3	0.2656	0.1251	-0.0005	-0.0001
4	0.0364	-0.0444	0.0002	0.0001
5	-0.0078	-0.0045	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1308.9325	-18.5123	0.9970	0.2717
1	1037.3640	-3.9580	0.0039	0.0011
2	-1.3145	5.4065	-0.0131	-0.0036
3	1.2190	0.5907	-0.0036	-0.0010
4	0.2911	-0.3554	0.0016	0.0004
5	-0.1252	-0.0722	0.0014	0.0004

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 19 THRU 24 JD 2443162.5 TO 2443168.5 DATES JAN 19 THRU JAN 24

A = 3.00000000 B = -7.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2459.0008	-12.3808	1.9066	0.5195
1	1044.4525	11.5097	-0.0352	-0.0096
2	1.2154	0.5270	-0.0002	-0.0001
3	-0.1282	-0.2591	0.0006	0.0002
4	-0.0212	0.0155	-0.0001	0.0
5	0.0041	0.0014	0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1228.2638	-6.7018	0.9534	0.2598
1	1044.8578	12.2943	-0.0352	-0.0096
2	2.6005	0.9297	0.0003	0.0001
3	-0.5956	-1.0653	-0.0042	-0.0012
4	-0.1696	0.1243	-0.0007	-0.0002
5	0.0662	0.0231	0.0052	0.0014

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 25 THRU 30 JD 2443168.5 TO 2443174.5 DATES JAN 25 THRU JAN 30

A = 3.00000000 B = -9.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2324.3860	27.5743	1.8204	0.4960
1	1046.7387	6.8697	-0.0023	-0.0006
2	-0.5178	-1.4272	0.0064	0.0017
3	-0.0688	-0.1105	-0.0003	-0.0001
4	0.0186	0.0025	-0.0001	0.0
5	0.0009	0.0004	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1162.7294	15.2169	0.9037	0.2462
1	1046.9492	7.2034	-0.0026	-0.0007
2	-1.1841	-2.8745	0.0134	0.0036
3	-0.2921	-0.4505	0.0032	0.0009
4	0.1484	0.0201	-0.0006	-0.0002
5	0.0136	0.0068	-0.0034	-0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 31 THRU 36 JD 2443174.5 TO 2443180.5 DATES JAN 31 THRU FEB 5

A = 3.00000000 B = -11.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2184.1979	26.9726	1.8821	0.5128
1	1043.6659	-7.4847	0.0283	0.0077
2	-0.0001	-1.7544	0.0003	0.0001
3	0.0541	0.1173	-0.0007	-0.0002
4	-0.0172	0.0228	0.0001	0.0
5	-0.0020	-0.0005	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1092.0819	15.2635	0.9408	0.2563
1	1043.4935	-7.8392	0.0302	0.0082
2	0.1370	-3.6909	0.0	0.0
3	0.2570	0.4792	-0.0019	-0.0005
4	-0.1373	0.1821	0.0007	0.0002
5	-0.0324	-0.0079	-0.0008	-0.0002

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 37 THRU 42 JD 2443180.5 TO 2443186.5 DATES FEB 6 THRU FEB 11

A = 3.00000000 B = -13.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2756.5192	-15.6280	1.9616	0.5345
1	1041.8216	-11.4242	0.0088	0.0024
2	-0.7266	1.0597	-0.0034	-0.0009
3	-0.0714	0.2799	0.0002	0.0
4	0.0211	-0.0053	0.0003	0.0001
5	0.0040	-0.0021	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1379.0073	-8.8790	0.9846	0.2683
1	1042.0555	-12.2747	0.0073	0.0020
2	-1.6219	2.1620	-0.0096	-0.0026
3	-0.3647	1.1625	0.0049	0.0013
4	0.1688	-0.0426	0.0028	0.0008
5	0.0633	-0.0342	-0.0034	-0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 43 THRU 48 JD 2443186.5 TO 2443192.5 DATES FEB 12 THRU FEB 17

A = 3.00000000 B = -15.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2597.5104	-30.5406	1.9480	0.5308
1	1040.0684	4.9690	-0.0165	-0.0045
2	0.8188	2.1909	-0.0037	-0.0010
3	0.1713	-0.1755	0.0001	0.0
4	-0.0313	-0.0302	0.0002	0.0
5	-0.0036	0.0041	0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1297.9052	-17.4914	0.9778	0.2664
1	1039.5366	5.5159	-0.0153	-0.0042
2	1.8877	4.6231	-0.0086	-0.0023
3	0.7569	-0.7840	-0.0055	-0.0015
4	-0.2501	-0.2413	0.0012	0.0003
5	-0.0574	0.0658	0.0046	0.0013

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 49 THRU 54 JD 2443192.5 TO 2443198.5 DATES FEB 18 THRU FEB 23

A = 3.00000000 B = -17.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2452.4807	6.8539	1.8552	0.5055
1	1046.9342	11.3876	-0.0253	-0.0069
2	0.3318	-0.5357	0.0025	0.0007
3	-0.1410	-0.1726	0.0007	0.0002
4	0.0028	0.0114	0.0	0.0
5	0.0014	-0.0006	0.0004	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1225.9114	3.9741	0.9251	0.2520
1	1047.3643	11.9026	-0.0256	-0.0070
2	0.6411	-1.1627	0.0051	0.0014
3	-0.5920	-0.6792	-0.0044	-0.0012
4	0.0225	0.0913	-0.0001	0.0
5	0.0224	-0.0092	0.0057	0.0015

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 55 THRU 60 JD 2443198.5 TO 2443204.5 DATES FEB 24 THRU MAR 1

A = 3.00000000 B = -19.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2318.0088	33.8874	1.8303	0.4987
1	1045.1586	1.0296	0.0158	0.0043
2	-0.4558	-1.8605	0.0059	0.0016
3	0.0315	-0.0539	-0.0002	-0.0001
4	0.0104	0.0100	-0.0002	-0.0001
5	-0.0013	0.0014	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1159.4706	18.8142	0.9090	0.2477
1	1045.0576	1.1982	0.0171	0.0047
2	-0.9950	-3.8012	0.0136	0.0037
3	0.1516	-0.2429	-0.0033	-0.0009
4	0.0835	0.0802	-0.0018	-0.0005
5	-0.0203	0.0217	0.0019	0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 61 THRU 66 JD 2443204.5 TO 2443210.5 DATES MAR 2 THRU MAR 7

A = 3.00000000 B = -21.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2173.9387	10.2363	1.9399	0.5286
1	1042.9901	-12.0380	0.0307	0.0084
2	-0.2857	-0.8560	-0.0036	-0.0010
3	-0.0658	0.2502	-0.0012	-0.0003
4	-0.0098	0.0194	-0.0001	0.0
5	0.0022	-0.0014	0.0002	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1087.2453	5.9936	0.9735	0.2652
1	1043.1985	-12.7955	0.0355	0.0097
2	-0.4933	-1.8673	-0.0063	-0.0017
3	-0.3076	1.0282	-0.0092	-0.0025
4	-0.0782	0.1552	-0.0009	-0.0003
5	0.0357	-0.0218	0.0034	0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 67 THRU 72 JD 2443210.5 TO 2443216.5 DATES MAR 8 THRU MAR 13

A = 3.00000000 B = -23.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2737.9965	-29.8517	1.9764	0.5385
1	1039.0123	-5.2341	-0.0122	-0.0033
2	-0.2273	2.3436	-0.0036	-0.0010
3	0.1840	0.1232	0.0004	0.0001
4	0.0216	-0.0388	0.0001	0.0
5	-0.0048	-0.0015	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1369.2472	-17.3083	0.9919	0.2703
1	1038.4360	-5.6112	-0.0145	-0.0039
2	-0.6273	4.9974	-0.0084	-0.0023
3	0.8327	0.5231	0.0056	0.0015
4	0.1726	-0.3102	0.0012	0.0003
5	-0.0772	-0.0243	-0.0030	-0.0008

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 73 THRU 78 JD 2443216.5 TO 2443222.5 DATES MAR 14 THRU MAR 19

A = 3.00000000 B = -25.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2582.5235	-16.9727	1.8974	0.5170
1	1044.3316	10.3982	-0.0238	-0.0065
2	0.9879	0.9144	0.0003	0.0001
3	-0.0852	-0.2370	0.0001	0.0
4	-0.0172	0.0024	0.0	0.0
5	0.0029	0.0017	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1290.2566	-9.3983	0.9484	0.2584
1	1044.6020	11.1177	-0.0247	-0.0067
2	2.1134	1.8093	0.0004	0.0001
3	-0.3995	-0.9814	0.0028	0.0008
4	-0.1376	0.0194	0.0002	0.0001
5	0.0469	0.0266	-0.0019	-0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 79 THRU 84 JD 2443222.5 TO 2443228.5 DATES MAR 20 THRU MAR 25

A = 3.00000000 B = -27.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2447.2054	23.6274	1.8208	0.4961
1	1046.9214	8.0661	-0.0109	-0.0030
2	-0.2652	-1.2811	0.0038	0.0010
3	-0.0539	-0.1189	0.0004	0.0001
4	0.0115	0.0082	0.0	0.0
5	0.0001	0.0003	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1223.8794	13.1030	0.9066	0.2470
1	1047.0834	8.4240	-0.0126	-0.0034
2	-0.6221	-2.6280	0.0075	0.0020
3	-0.2167	-0.4808	0.0032	0.0009
4	0.0916	0.0657	0.0	0.0
5	0.0009	0.0043	-0.0012	-0.0003

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 85 THRU 90 JD 2443228.5 TO 2443234.5 DATES MAR 26 THRU MAR 31

A = 3.00000000 B = -29.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2310.0721	29.7690	1.8599	0.5068
1	1044.6095	-5.4489	0.0321	0.0087
2	-0.1962	-1.8130	0.0051	0.0014
3	0.0041	0.0465	-0.0001	0.0
4	-0.0102	0.0149	-0.0001	0.0
5	-0.0010	0.0009	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1155.2220	16.7124	0.9247	0.2519
1	1044.5923	-5.5835	0.0324	0.0088
2	-0.3105	-3.7455	0.0112	0.0030
3	0.0365	0.1670	-0.0002	-0.0001
4	-0.0819	0.1195	-0.0009	-0.0002
5	-0.0162	0.0151	-0.0001	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 91 THRU 96 JD 2443234.5 TO 2443240.5 DATES APR 1 THRU APR 6

A = 3.00000000 B = -31.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2161.8080	-10.1640	1.9914	0.5426
1	1040.5933	-12.4802	0.0223	0.0061
2	-0.9254	0.6288	-0.0079	-0.0022
3	-0.0349	0.3520	-0.0011	-0.0003
4	0.0258	0.0059	0.0	0.0
5	0.0043	-0.0049	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1081.8552	-5.7049	1.0036	0.2734
1	1040.7197	-13.5606	0.0256	0.0070
2	-2.0571	1.2107	-0.0156	-0.0042
3	-0.2264	1.5053	-0.0042	-0.0011
4	0.2064	0.0468	-0.0002	-0.0001
5	0.0693	-0.0777	-0.0002	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 97 THRU 102 JD 2443240.5 TO 2443246.5 DATES APR 7 THRU APR 12

A = 3.00000000 B = -33.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2718.3133	-31.3101	1.9615	0.5345
1	1039.4875	3.3678	-0.0311	-0.0085
2	1.0941	2.2988	-0.0021	-0.0006
3	0.1582	-0.1747	0.0010	0.0003
4	-0.0413	-0.0266	-0.0001	0.0
5	-0.0023	0.0050	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1358.0212	-17.9804	0.9827	0.2678
1	1039.0015	3.9172	-0.0335	-0.0091
2	2.5189	4.8103	-0.0033	-0.0009
3	0.6785	-0.7997	0.0015	0.0004
4	-0.3306	-0.2127	-0.0009	-0.0002
5	-0.0366	0.0806	0.0019	0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 103 THRU 108 JD 2443246.5 TO 2443252.5 DATES APR 13 THRU APR 18

A = 3.00000000 B = -35.33333333

AN ANNULAR ECLIPSE OF THE SUN OCCURS ON APRIL 18. THE ECLIPSE BEGINS AT 07 33 GMT AND ENDS AT 13 29 GMT.

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 109 THRU 114 JD 2443252.5 TO 2443258.5 DATES APR 19 THRU APR 24

A = 3.00000000 B = -37.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2440.3346	32.9700	1.8099	0.4931
1	1045.8994	2.5454	0.0041	0.0011
2	-0.2703	-1.7459	0.0046	0.0013
3	0.0466	-0.0517	0.0001	0.0
4	0.0055	0.0121	0.0002	0.0
5	-0.0021	0.0004	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1220.4431	18.2430	0.9005	0.2454
1	1045.7494	2.7025	0.0045	0.0012
2	-0.5844	-3.5889	0.0078	0.0021
3	0.2274	-0.2147	-0.0023	-0.0006
4	0.0439	0.0970	0.0014	0.0004
5	-0.0329	0.0062	0.0022	0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 115 THRU 120 JD 2443258.5 TO 2443264.5 DATES APR 25 THRU APR 30

A = 3.00000000 B = -39.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2301.3335	15.9269	1.9046	0.5189
1	1044.5332	-10.6131	0.0422	0.0115
2	-0.3901	-1.1947	0.0032	0.0009
3	-0.1176	0.1544	-0.0007	-0.0002
4	-0.0128	0.0183	-0.0001	0.0
5	0.0016	0.0015	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1151.0440	9.1765	0.9491	0.2586
1	1044.8940	-11.0689	0.0442	0.0120
2	-0.6776	-2.5362	0.0069	0.0019
3	-0.5021	0.5884	-0.0027	-0.0007
4	-0.1025	0.1468	-0.0006	-0.0002
5	0.0253	0.0233	0.0	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 121 THRU 126 JD 2443264.5 TO 2443270.5 DATES MAY 1 THRU MAY 6

A = 3.00000000 B = -41.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2145.6808	-26.4580	2.0204	0.5505
1	1037.1654	-7.6196	0.0030	0.0008
2	-0.7944	2.2428	-0.0110	-0.0030
3	0.2528	0.2681	0.0001	0.0
4	0.0506	-0.0441	0.0002	0.0001
5	-0.0051	-0.0077	-0.0002	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1073.6854	-15.5158	1.0214	0.2783
1	1036.3813	-8.4624	0.0018	0.0005
2	-1.9936	4.8380	-0.0239	-0.0065
3	1.1137	1.2259	0.0040	0.0011
4	0.4047	-0.3524	0.0019	0.0005
5	-0.0820	-0.1227	-0.0029	-0.0008

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 127 THRU 132 JD 2443270.5 TO 2443276.5 DATES MAY 7 THRU MAY 12

A = 3.00000000 B = -43.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2702.2679	-20.0329	1.9242	0.5243
1	1043.1759	9.7362	-0.0402	-0.0110
2	1.4697	1.0958	0.0017	0.0005
3	-0.1149	-0.2593	0.0007	0.0002
4	-0.0291	0.0112	0.0002	0.0
5	0.0058	0.0015	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1349.6352	-11.1011	0.9606	0.2617
1	1043.5494	10.5218	-0.0426	-0.0116
2	3.1723	2.1021	0.0021	0.0006
3	-0.5748	-1.0676	0.0037	0.0010
4	-0.2329	0.0895	0.0012	0.0003
5	0.0921	0.0242	-0.0007	-0.0002

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 133 THRU 138 JD 2443276.5 TO 2443282.5 DATES MAY 13 THRU MAY 18

A = 3.00000000 B = -45.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2566.4825	20.7771	1.8161	0.4948
1	1047.3846	8.8625	-0.0129	-0.0035
2	-0.3047	-1.0948	0.0033	0.0009
3	-0.0717	-0.1329	-0.0002	-0.0001
4	0.0187	0.0046	0.0002	0.0
5	0.0005	0.0005	-0.0003	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1283.5646	11.4880	0.9049	0.2466
1	1047.6023	9.2639	-0.0136	-0.0037
2	-0.7591	-2.2267	0.0054	0.0015
3	-0.2973	-0.5421	0.0050	0.0014
4	0.1498	0.0370	0.0012	0.0003
5	0.0084	0.0082	-0.0048	-0.0013

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 139 THRU 144 JD 2443282.5 TO 2443288.5 DATES MAY 19 THRU MAY 24

A = 3.00000000 B = -47.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2431.5821	31.8958	1.8239	0.4969
1	1045.5346	-3.8736	0.0174	0.0047
2	0.0642	-1.7601	0.0042	0.0011
3	0.0388	0.0470	-0.0002	0.0
4	-0.0156	0.0127	-0.0005	-0.0001
5	-0.0024	-0.0007	0.0002	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1215.7113	17.7207	0.9072	0.2472
1	1045.4063	-4.0178	0.0189	0.0052
2	0.2533	-3.6218	0.0124	0.0034
3	0.2025	0.2013	-0.0048	-0.0013
4	-0.1250	0.1016	-0.0039	-0.0011
5	-0.0377	-0.0108	0.0034	0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 145 THRU 150 JD 2443288.5 TO 2443294.5 DATES MAY 25 THRU MAY 30

A = 3.00000000 B = -49.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2290.8164	-3.7220	1.9518	0.5318
1	1043.0857	-12.5113	0.0425	0.0116
2	-1.0856	-0.0273	-0.0008	-0.0002
3	-0.1693	0.2711	-0.0011	-0.0003
4	0.0100	0.0221	-0.0001	0.0
5	0.0050	0.0002	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1146.5038	-1.8117	0.9766	0.2661
1	1043.6185	-13.3238	0.0454	0.0124
2	-2.2509	-0.2310	-0.0008	-0.0002
3	-0.7769	1.0811	-0.0029	-0.0008
4	0.0797	0.1764	-0.0009	-0.0002
5	0.0799	0.0027	-0.0010	-0.0003

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 151 THRU 156 JD 2443294.5 TO 2443300.5 DATES MAY 31 THRU JUNE 5

A = 3.00000000 B = -51.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2126.7468	-31.8933	2.0159	0.5493
1	1036.3138	0.9424	-0.0194	-0.0053
2	0.6000	2.7575	-0.0103	-0.0028
3	0.3892	-0.0911	0.0014	0.0004
4	-0.0299	-0.0633	0.0005	0.0001
5	-0.0135	0.0047	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1062.7435	-18.7675	1.0187	0.2776
1	1035.0787	1.2391	-0.0234	-0.0064
2	1.4391	6.0218	-0.0244	-0.0066
3	1.8273	-0.4586	0.0051	0.0014
4	-0.2392	-0.5068	0.0038	0.0010
5	-0.2166	0.0755	0.0003	0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 157 THRU 162 JD 2443300.5 TO 2443306.5 DATES JUNE 6 THRU JUNE 11

A = 3.00000000 B = -53.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2692.0810	-1.5420	1.8785	0.5118
1	1046.3900	11.6912	-0.0367	-0.0100
2	0.7825	-0.1319	0.0045	0.0012
3	-0.2025	-0.1850	0.0003	0.0001
4	0.0028	0.0134	0.0	0.0
5	0.0024	-0.0017	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1345.2608	-0.6257	0.9348	0.2547
1	1047.0096	12.2377	-0.0382	-0.0104
2	1.5425	-0.3709	0.0087	0.0024
3	-0.8587	-0.7060	0.0039	0.0011
4	0.0225	0.1070	0.0002	0.0001
5	0.0391	-0.0271	-0.0023	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 163 THRU 168 JD 2443306.5 TO 2443312.5 DATES JUNE 12 THRU JUNE 17

A = 3.00000000 B = -55.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2559.1094	32.0509	1.8063	0.4922
1	1046.1182	3.8256	0.0002	0.0001
2	-0.3937	-1.6712	0.0039	0.0011
3	0.0456	-0.0767	-0.0002	-0.0001
4	0.0170	0.0110	0.0002	0.0
5	-0.0016	0.0009	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1279.9653	17.7077	0.8994	0.2451
1	1045.9733	4.0604	0.0002	0.0001
2	-0.9231	-3.4308	0.0064	0.0017
3	0.2147	-0.3256	0.0019	0.0005
4	0.1357	0.0883	0.0014	0.0004
5	-0.0257	0.0150	-0.0023	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 169 THRU 174 JD 2443312.5 TO 2443318.5 DATES JUNE 18 THRU JUNE 23

A = 3.00000000 B = -57.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2422.0277	20.2281	1.8594	0.5066
1	1045.7996	-9.3638	0.0267	0.0073
2	0.0688	-1.2332	0.0032	0.0009
3	-0.0785	0.1384	0.0002	0.0001
4	-0.0215	0.0087	0.0003	0.0001
5	0.0008	-0.0003	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1210.9234	11.3559	0.9268	0.2525
1	1046.0391	-9.7805	0.0253	0.0069
2	0.3100	-2.5358	0.0041	0.0011
3	-0.3298	0.5596	0.0039	0.0011
4	-0.1723	0.0694	0.0024	0.0006
5	0.0126	-0.0048	-0.0024	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 175 THRU 180 JD 2443318.5 TO 2443324.5 DATES JUNE 24 THRU JUNE 29

A = 3.00000000 B = -59.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2276.0414	-22.2152	1.9868	0.5414
1	1039.8140	-9.5508	0.0298	0.0081
2	-1.4562	1.5371	-0.0052	-0.0014
3	0.0155	0.3197	-0.0014	-0.0004
4	0.0546	-0.0024	0.0001	0.0
5	0.0056	-0.0059	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1139.5314	-12.6472	0.9987	0.2721
1	1039.7955	-10.5394	0.0329	0.0090
2	-3.3489	3.0938	-0.0109	-0.0030
3	-0.0504	1.3965	-0.0015	-0.0004
4	0.4366	-0.0196	0.0006	0.0002
5	0.0901	-0.0940	-0.0032	-0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 181 THRU 186 JD 2443324.5 TO 2443330.5 DATES JUNE 30 THRU JULY 5

A = 3.00000000 B = -61.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2109.2788	-24.4095	1.9802	0.5395
1	1039.5952	8.6114	-0.0343	-0.0094
2	1.5495	1.7031	-0.0061	-0.0016
3	0.0780	-0.3188	0.0019	0.0005
4	-0.0603	-0.0077	0.0	0.0
5	0.0041	0.0073	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1053.0295	-13.9155	0.9962	0.2714
1	1039.3816	9.6044	-0.0400	-0.0109
2	3.5815	3.4679	-0.0125	-0.0034
3	0.2304	-1.4217	0.0079	0.0022
4	-0.4824	-0.0618	0.0004	0.0001
5	0.0653	0.1172	-0.0003	-0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 187 THRU 192 JD 2443330.5 TO 2443336.5 DATES JULY 6 THRU JULY 11

A = 3.00000000 B = -63.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2685.5961	16.9647	1.8409	0.5016
1	1047.1548	9.8212	-0.0247	-0.0067
2	0.0096	-1.0021	0.0057	0.0015
3	-0.1400	-0.1244	0.0	0.0
4	0.0145	0.0059	0.0	0.0
5	0.0013	-0.0009	0.0002	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1342.8030	9.4904	0.9148	0.2493
1	1047.5813	10.1899	-0.0240	-0.0065
2	-0.0973	-2.0516	0.0111	0.0030
3	-0.5860	-0.4799	-0.0032	-0.0009
4	0.1164	0.0475	0.0003	0.0001
5	0.0207	-0.0141	0.0027	0.0007

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 193 THRU 198 JD 2443336.5 TO 2443342.5 DATES JULY 12 THRU JULY 17

A = 3.00000000 B = -65.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2550.3983	33.0504	1.8226	0.4966
1	1045.2151	-2.4919	0.0131	0.0036
2	-0.0609	-1.8292	0.0031	0.0009
3	0.0839	0.0227	-0.0004	-0.0001
4	-0.0040	0.0170	0.0	0.0
5	-0.0031	0.0002	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1275.2560	18.3714	0.9082	0.2475
1	1044.9480	-2.5590	0.0139	0.0038
2	-0.0898	-3.7944	0.0061	0.0017
3	0.3971	0.0868	0.0001	0.0
4	-0.0320	0.1360	0.0002	0.0
5	-0.0492	0.0031	-0.0014	-0.0004

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 199 THRU 204 JD 2443342.5 TO 2443348.5 DATES JULY 18 THRU JULY 23

A = 3.00000000 B = -67.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2411.4206	1.2517	1.9069	0.5196
1	1044.9567	-12.0489	0.0274	0.0075
2	-0.4722	-0.2208	0.0008	0.0002
3	-0.1572	0.2195	-0.0004	-0.0001
4	-0.0067	0.0093	-0.0001	0.0
5	0.0025	0.0003	0.0002	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1206.1758	0.8559	0.9526	0.2596
1	1045.4407	-12.7060	0.0292	0.0080
2	-0.8907	-0.5158	0.0020	0.0005
3	-0.6783	0.8726	-0.0047	-0.0013
4	-0.0537	0.0742	-0.0005	-0.0001
5	0.0395	0.0043	0.0026	0.0007

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 205 THRU 210 JD 2443348.5 TO 2443354.5 DATES JULY 24 THRU JULY 29

A = 3.00000000 B = -69.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2256.8138	-31.7123	1.9936	0.5432
1	1037.6167	-1.9988	0.0088	0.0024
2	-0.4973	2.5819	-0.0065	-0.0018
3	0.2971	0.0955	-0.0004	-0.0001
4	0.0303	-0.0495	0.0001	0.0
5	-0.0089	-0.0042	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1128.9346	-18.4875	1.0034	0.2734
1	1036.6810	-2.3064	0.0108	0.0029
2	-1.2374	5.5593	-0.0141	-0.0038
3	1.3661	0.4661	-0.0046	-0.0012
4	0.2427	-0.3956	0.0012	0.0003
5	-0.1423	-0.0672	0.0023	0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 211 THRU 216 JD 2443354.5 TO 2443360.5 DATES JULY 30 THRU AUG 4

A = 3.00000000 B = -71.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2816.8901	-7.6449	1.9255	0.5246
1	1043.8373	11.9281	-0.0379	-0.0103
2	1.1230	0.2391	-0.0012	-0.0003
3	-0.1336	-0.2649	0.0013	0.0004
4	-0.0164	0.0180	0.0002	0.0001
5	0.0045	0.0008	0.0004	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1407.3056	-4.0436	0.9641	0.2627
1	1044.2608	12.7265	-0.0400	-0.0109
2	2.3773	0.3344	-0.0038	-0.0010
3	-0.6250	-1.0747	-0.0020	-0.0005
4	-0.1313	0.1439	0.0015	0.0004
5	0.0725	0.0122	0.0058	0.0016

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 217 THRU 222 JD 2443360.5 TO 2443366.5 DATES AUG 5 THRU AUG 10

A = 3.00000000 B = -73.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2679.5373	29.7144	1.8215	0.4963
1	1046.2457	5.2596	-0.0079	-0.0022
2	-0.3078	-1.5850	0.0060	0.0016
3	-0.0281	-0.0789	0.0	0.0
4	0.0164	0.0066	0.0	0.0
5	-0.0001	0.0006	-0.0003	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1340.0929	16.4488	0.9048	0.2465
1	1046.3295	5.4990	-0.0094	-0.0026
2	-0.7471	-3.2231	0.0118	0.0032
3	-0.1105	-0.3268	0.0059	0.0016
4	0.1314	0.0532	0.0002	0.0001
5	-0.0014	0.0090	-0.0048	-0.0013

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 223 THRU 228 JD 2443366.5 TO 2443372.5 DATES AUG 11 THRU AUG 16

A = 3.00000000 B = -75.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2541.4210	23.3324	1.8615	0.5072
1	1045.0635	-8.3480	0.0241	0.0066
2	0.0571	-1.4391	0.0010	0.0003
3	-0.0063	0.1314	-0.0001	0.0
4	-0.0162	0.0158	0.0	0.0
5	-0.0005	-0.0005	-0.0003	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1270.6372	13.1211	0.9297	0.2533
1	1045.0800	-8.7448	0.0232	0.0063
2	0.2438	-3.0047	0.0023	0.0006
3	-0.0157	0.5360	0.0046	0.0012
4	-0.1296	0.1264	-0.0002	-0.0001
5	-0.0076	-0.0083	-0.0040	-0.0011

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 229 THRU 234 JD 2443372.5 TO 2443378.5 DATES AUG 17 THRU AUG 22

A = 3.00000000 B = -77.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2397.3168	-18.3919	1.9499	0.5313
1	1041.9759	-10.2946	0.0174	0.0047
2	-0.9506	1.1922	-0.0022	-0.0006
3	-0.0556	0.2640	-0.0001	0.0
4	0.0254	-0.0032	0.0002	0.0001
5	0.0040	-0.0023	0.0002	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1199.6344	-10.3913	0.9773	0.2663
1	1042.1628	-11.0980	0.0189	0.0051
2	-2.1044	2.4100	-0.0059	-0.0016
3	-0.3030	1.1017	-0.0049	-0.0013
4	0.2033	-0.0257	0.0016	0.0004
5	0.0646	-0.0366	0.0035	0.0010

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA*FOR YEAR 1977

DAYS 235 THRU 240 JD 2443378.5 TO 2443384.5 DATES AUG 23 THRU AUG 28

A = 3.00000000 B = -79.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2237.1123	-27.8985	1.9672	0.5360
1	1039.5197	6.3454	-0.0115	-0.0031
2	0.8138	2.0802	-0.0052	-0.0014
3	0.1616	-0.2079	-0.0002	-0.0001
4	-0.0349	-0.0301	-0.0001	0.0
5	-0.0027	0.0044	0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1117.7075	-16.0595	0.9887	0.2694
1	1039.0213	6.9907	-0.0095	-0.0026
2	1.9067	4.4011	-0.0093	-0.0025
3	0.7009	-0.9185	-0.0062	-0.0017
4	-0.2791	-0.2407	-0.0011	-0.0003
5	-0.0437	0.0697	0.0044	0.0012

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 241 THRU 246 JD 2443384.5 TO 2443390.5 DATES AUG 29 THRU SEPT 3

A = 3.00000000 B = -81.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2809.1324	11.4798	1.8722	0.5101
1	1045.9766	10.8469	-0.0300	-0.0082
2	0.3022	-0.8299	0.0020	0.0006
3	-0.1179	-0.1661	0.0009	0.0002
4	0.0067	0.0141	0.0	0.0
5	0.0012	-0.0002	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1404.2707	6.5839	0.9340	0.2545
1	1046.3365	11.3440	-0.0326	-0.0089
2	0.5508	-1.7725	0.0043	0.0012
3	-0.4964	-0.6598	0.0033	0.0009
4	0.0537	0.1126	-0.0003	-0.0001
5	0.0198	-0.0035	0.0001	0.0

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 247 THRU 252 JD 2443390.5 TO 2443396.5 DATES SEPT 4 THRU SEPT 9

A = 3.00000000 B = -83.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2672.6894	33.2139	1.8248	0.4972
1	1045.4260	-0.7943	0.0100	0.0027
2	-0.1570	-1.8138	0.0060	0.0016
3	0.0305	-0.0066	-0.0005	-0.0001
4	0.0022	0.0108	-0.0001	0.0
5	-0.0018	0.0007	0.0003	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1336.5039	18.4316	0.9063	0.2470
1	1045.3251	-0.7712	0.0130	0.0035
2	-0.3315	-3.7139	0.0125	0.0034
3	0.1591	-0.0398	-0.0081	-0.0022
4	0.0176	0.0862	-0.0004	-0.0001
5	-0.0295	0.0107	0.0050	0.0014

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 253 THRU 258 JD 2443396.5 TO 2443402.5 DATES SEPT 10 THRU SEPT 15

A = 3.00000000 B = -85.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2532.2318	5.7251	1.9161	0.5221
1	1044.1477	-11.8872	0.0292	0.0080
2	-0.4109	-0.5272	-0.0023	-0.0006
3	-0.0939	0.2346	-0.0007	-0.0002
4	-0.0051	0.0151	0.0004	0.0001
5	0.0018	-0.0011	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1266.5217	3.4048	0.9607	0.2618
1	1044.4386	-12.5964	0.0304	0.0083
2	-0.7809	-1.1753	-0.0076	-0.0021
3	-0.4121	0.9602	0.0010	0.0003
4	-0.0409	0.1209	0.0029	0.0008
5	0.0292	-0.0175	-0.0031	-0.0009

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 259 THRU 264 JD 2443402.5 TO 2443408.5 DATES SEPT 16 THRU SEPT 21

A = 3.00000000 B = -87.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2378.4832	-30.4653	1.9725	0.5374
1	1038.9964	-3.7103	-0.0022	-0.0006
2	-0.3148	2.3577	-0.0035	-0.0010
3	0.1986	0.1026	0.0004	0.0001
4	0.0189	-0.0378	0.0	0.0
5	-0.0050	-0.0018	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1189.5752	-17.6282	0.9898	0.2697
1	1038.3754	-4.0272	-0.0045	-0.0012
2	-0.7804	5.0178	-0.0073	-0.0020
3	0.8951	0.4470	0.0064	0.0017
4	0.1509	-0.3024	0.0002	0.0001
5	-0.0806	-0.0293	-0.0040	-0.0011

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 265 THRU 270 JD 2443408.5 TO 2443414.5 DATES SEPT 22 THRU SEPT 27

A = 3.00000000 B = -89.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2221.6559	-12.7417	1.9198	0.5231
1	1043.6347	11.1027	-0.0228	-0.0062
2	0.8731	0.6946	-0.0021	-0.0006
3	-0.0860	-0.2561	0.0003	0.0001
4	-0.0140	0.0032	-0.0001	0.0
5	0.0034	0.0017	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1109.9408	-7.0623	0.9619	0.2621
1	1043.9096	11.8795	-0.0241	-0.0066
2	1.8586	1.3637	-0.0036	-0.0010
3	-0.4116	-1.0585	0.0030	0.0008
4	-0.1123	0.0255	-0.0006	-0.0002
5	0.0541	0.0274	-0.0014	-0.0004

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 271 THRU 276 JD 2443414.5 TO 2443420.5 DATES SEPT 28 THRU OCT 3

A = 3.00000000 B = -91.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2802.7755	26.5321	1.8311	0.4989
1	1046.0583	6.6979	-0.0169	-0.0046
2	-0.1200	-1.4962	0.0042	0.0011
3	-0.0174	-0.0920	0.0008	0.0002
4	0.0108	0.0114	-0.0001	0.0
5	-0.0004	-0.0002	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1401.5185	14.7737	0.9113	0.2483
1	1046.1087	6.9731	-0.0198	-0.0054
2	-0.3263	-3.0839	0.0092	0.0025
3	-0.0622	-0.3645	0.0055	0.0015
4	0.0864	0.0915	-0.0008	-0.0002
5	-0.0059	-0.0028	-0.0019	-0.0005

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 277 THRU 282 JD 2443420.5 TO 2443426.5 DATES OCT 4 THRU OCT 9

A = 3.00000000 B = -93.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2665.6776	26.5362	1.8503	0.5042
1	1045.4832	-6.7627	0.0270	0.0074
2	-0.0623	-1.5781	0.0051	0.0014
3	-0.0378	0.0772	-0.0004	-0.0001
4	-0.0123	0.0118	-0.0004	-0.0001
5	0.0	0.0005	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1332.8888	14.8580	0.9196	0.2506
1	1045.5967	-6.9918	0.0286	0.0078
2	-0.0262	-3.2508	0.0137	0.0037
3	-0.1518	0.2985	-0.0032	-0.0009
4	-0.0984	0.0946	-0.0035	-0.0010
5	0.0006	0.0084	0.0012	0.0003

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 283 THRU 288 JD 2443426.5 TO 2443432.5 DATES OCT 10 THRU OCT 15

A = 3.00000000 B = -95.33333333

A TOTAL ECLIPSE OF THE SUN OCCURS ON OCTOBER 12. THE ECLIPSE BEGINS AT 17 48 GMT AND ENDS AT 23 06 GMT.

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 289 THRU 294 JD 2443432.5 TO 2443438.5 DATES OCT 16 THRU OCT 21

A = 3.00000000 B = -97.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2358.1717	-29.4887	1.9650	0.5354
1	1039.5885	4.7654	-0.0234	-0.0064
2	1.0229	2.1634	-0.0025	-0.0007
3	0.1332	-0.1895	0.0009	0.0002
4	-0.0417	-0.0243	0.0002	0.0001
5	-0.0015	0.0048	0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1178.0212	-16.9321	0.9852	0.2684
1	1039.1814	5.3579	-0.0256	-0.0070
2	2.3797	4.5215	-0.0069	-0.0019
3	0.5625	-0.8543	0.0018	0.0005
4	-0.3338	-0.1946	0.0020	0.0005
5	-0.0237	0.0770	0.0014	0.0004

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 295 THRU 300 JD 2443438.5 TO 2443444.5 DATES OCT 22 THRU OCT 27

A = 3.00000000 B = -99.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2211.3873	6.9941	1.8672	0.5088
1	1046.2366	11.2096	-0.0231	-0.0063
2	0.2041	-0.5067	0.0010	0.0003
3	-0.1186	-0.1863	-0.0001	0.0
4	0.0105	0.0075	0.0	0.0
5	0.0014	0.0003	-0.0003	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1105.5001	4.0113	0.9326	0.2541
1	1046.5994	11.7702	-0.0240	-0.0065
2	0.3239	-1.0738	0.0021	0.0006
3	-0.5023	-0.7519	0.0045	0.0012
4	0.0842	0.0603	-0.0002	0.0
5	0.0224	0.0053	-0.0041	-0.0011

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 301 THRU 306 JD 2443444.5 TO 2443450.5 DATES OCT 28 THRU NOV 2

A = 3.00000000 B = -101.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2795.6667	33.1954	1.8120	0.4937
1	1045.7597	0.8250	-0.0013	-0.0003
2	0.0062	-1.7718	0.0047	0.0013
3	0.0513	-0.0082	0.0	0.0
4	-0.0027	0.0124	0.0001	0.0
5	-0.0026	-0.0004	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1397.8245	18.3819	0.9014	0.2456
1	1045.5926	0.8476	-0.0020	-0.0005
2	0.0340	-3.6431	0.0090	0.0024
3	0.2577	-0.0249	0.0028	0.0008
4	-0.0217	0.0995	0.0004	0.0001
5	-0.0421	-0.0064	-0.0022	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 307 THRU 312 JD 2443450.5 TO 2443456.5 DATES NOV 3 THRU NOV 8

A = 3.00000000 B = -103.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2658.6997	11.4580	1.8921	0.5155
1	1045.3545	-10.9717	0.0405	0.0110
2	-0.4885	-0.9017	0.0031	0.0008
3	-0.1480	0.1599	-0.0009	-0.0003
4	-0.0084	0.0165	-0.0003	-0.0001
5	0.0018	0.0016	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1329.8300	6.6472	0.9426	0.2568
1	1045.8075	-11.4435	0.0421	0.0115
2	-0.9100	-1.9354	0.0089	0.0024
3	-0.6277	0.6082	0.0010	0.0003
4	-0.0669	0.1320	-0.0027	-0.0007
5	0.0285	0.0249	-0.0038	-0.0010

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 313 THRU 318 JD 2443456.5 TO 2443462.5 DATES NOV 9 THRU NOV 14

A = 3.00000000 B = -105.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2504.5104	-28.1037	2.0114	0.5481
1	1037.1961	-5.9938	0.0075	0.0020
2	-0.7610	2.3536	-0.0103	-0.0028
3	0.2864	0.2223	0.0003	0.0001
4	0.0448	-0.0474	0.0005	0.0001
5	-0.0069	-0.0067	-0.0002	-0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1253.0610	-16.4528	1.0165	0.2769
1	1036.3023	-6.6946	0.0056	0.0015
2	-1.8804	5.0861	-0.0244	-0.0066
3	1.2839	1.0243	0.0055	0.0015
4	0.3584	-0.3789	0.0038	0.0010
5	-0.1107	-0.1079	-0.0035	-0.0010

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 319 THRU 324 JD 2443462.5 TO 2443468.5 DATES NOV 15 THRU NOV 20

A = 3.00000000 B = -107.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2341.4231	-16.3029	1.9335	0.5268
1	1043.1130	10.5150	-0.0365	-0.0099
2	1.3127	0.8741	0.0011	0.0003
3	-0.1311	-0.2603	0.0011	0.0003
4	-0.0231	0.0114	-0.0002	0.0
5	0.0053	0.0013	0.0	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1169.3757	-9.0141	0.9655	0.2631
1	1043.5332	11.3021	-0.0398	-0.0108
2	2.8104	1.6566	0.0035	0.0009
3	-0.6316	-1.0665	0.0046	0.0013
4	-0.1850	0.0915	-0.0014	-0.0004
5	0.0856	0.0204	-0.0003	-0.0001

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 325 THRU 330 JD 2443468.5 TO 2443474.5 DATES NOV 21 THRU NOV 26

A = 3.00000000 B = -109.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2203.3681	23.9598	1.8258	0.4975
1	1046.4934	7.8034	-0.0161	-0.0044
2	-0.2498	-1.3153	0.0026	0.0007
3	-0.0279	-0.1205	0.0002	0.0
4	0.0196	0.0086	0.0	0.0
5	-0.0001	0.0007	0.0004	0.0001

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1101.9535	13.3038	0.9103	0.2480
1	1046.5764	8.1683	-0.0147	-0.0040
2	-0.6565	-2.6994	0.0051	0.0014
3	-0.1091	-0.4958	-0.0067	-0.0018
4	0.1568	0.0688	0.0001	0.0
5	-0.0019	0.0111	0.0058	0.0016

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 331 THRU 336 JD 2443474.5 TO 2443480.5 DATES NOV 27 THRU DEC 2

A = 3.00000000 B = -111.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2787.8810	29.5492	1.8169	0.4951
1	1046.2460	-5.2276	0.0129	0.0035
2	0.2407	-1.5788	0.0051	0.0014
3	-0.0020	0.0765	0.0003	0.0001
4	-0.0195	0.0082	-0.0004	-0.0001
5	-0.0009	-0.0009	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1393.6803	16.3616	0.9029	0.2460
1	1046.2475	-5.4613	0.0116	0.0032
2	0.6372	-3.2229	0.0136	0.0037
3	0.0095	0.3231	0.0026	0.0007
4	-0.1559	0.0653	-0.0034	-0.0009
5	-0.0139	-0.0137	-0.0011	-0.0003

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 337 THRU 342 JD 2443480.5 TO 2443486.5 DATES DEC 3 THRU DEC 8

A = 3.00000000 B = -113.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2649.8596	-7.6694	1.9401	0.5286
1	1043.4298	-11.9121	0.0446	0.0122
2	-1.2749	0.2179	0.0001	0.0
3	-0.1698	0.2646	-0.0014	-0.0004
4	0.0154	0.0219	-0.0002	-0.0001
5	0.0054	0.0001	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1326.2201	-4.0307	0.9697	0.2642
1	1043.9660	-12.7053	0.0484	0.0132
2	-2.6729	0.2608	0.0018	0.0005
3	-0.7865	1.0560	-0.0043	-0.0012
4	0.1231	0.1751	-0.0015	-0.0004
5	0.0858	0.0019	-0.0009	-0.0002

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 343 THRU 348 JD 2443486.5 TO 2443492.5 DATES DEC 9 THRU DEC 14

A = 3.00000000 B = -115.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2485.7739	-30.8803	2.0209	0.5506
1	1036.2238	2.5533	-0.0145	-0.0040
2	0.6776	2.6783	-0.0107	-0.0029
3	0.3786	-0.1363	0.0011	0.0003
4	-0.0400	-0.0605	0.0002	0.0001
5	-0.0123	0.0061	-0.0002	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1242.1693	-18.1790	1.0214	0.2783
1	1035.0266	2.9928	-0.0184	-0.0050
2	1.6754	5.8405	-0.0233	-0.0063
3	1.7601	-0.6674	0.0073	0.0020
4	-0.3203	-0.4839	0.0019	0.0005
5	-0.1967	0.0977	-0.0024	-0.0007

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 349 THRU 354 JD 2443492.5 TO 2443498.5 DATES DEC 15 THRU DEC 20

A = 3.00000000 B = -117.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2330.2491	2.8273	1.8897	0.5149
1	1045.8598	11.6291	-0.0377	-0.0103
2	0.6576	-0.3792	0.0039	0.0011
3	-0.1914	-0.1820	0.0003	0.0001
4	0.0059	0.0130	-0.0004	-0.0001
5	0.0024	-0.0016	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1164.4728	1.8058	0.9406	0.2563
1	1046.4461	12.1673	-0.0391	-0.0106
2	1.2681	-0.8626	0.0109	0.0030
3	-0.8143	-0.6968	0.0029	0.0008
4	0.0472	0.1042	-0.0031	-0.0009
5	0.0390	-0.0251	-0.0012	-0.0003

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 355 THRU 360 JD 2443498.5 TO 2443504.5 DATES DEC 21 THRU DEC 26

A = 3.00000000 B = -119.33333333

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2195.1153	32.8672	1.8060	0.4921
1	1045.8811	2.2559	-0.0042	-0.0011
2	-0.1615	-1.7364	0.0037	0.0010
3	0.0694	-0.0391	-0.0004	-0.0001
4	0.0104	0.0142	0.0	0.0
5	-0.0026	0.0008	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1097.7296	18.1842	0.8993	0.2450
1	1045.6598	2.3772	-0.0038	-0.0010
2	-0.4063	-3.5862	0.0076	0.0021
3	0.3302	-0.1720	0.0012	0.0003
4	0.0833	0.1133	-0.0002	-0.0001
5	-0.0422	0.0125	-0.0022	-0.0006

CHEBYSHEV APPROXIMATION OF NAUTICAL ALMANAC DATA FOR YEAR 1977

DAYS 360 THRU 365 JD 2443503.5 TO 2443509.5 DATES DEC 26 THRU DEC 31

A = 3.00000000 B = -121.00000000

CHEBYSHEV COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	2082.4049	22.2256	1.8299	0.4986
1	1046.6913	-8.3791	0.0190	0.0052
2	0.2106	-1.2285	0.0041	0.0011
3	-0.0623	0.1225	0.0002	0.0001
4	-0.0204	0.0064	0.0001	0.0
5	0.0004	-0.0006	-0.0001	0.0

POWERS OF TIME COEFFICIENTS

	MOON GHA	MOON DEC	MOON H P	MOON S D
	0	0	0	0
0	1040.9714	12.3478	0.9110	0.2482
1	1046.8801	-8.7497	0.0179	0.0049
2	0.5844	-2.5087	0.0076	0.0021
3	-0.2574	0.5023	0.0032	0.0009
4	-0.1632	0.0516	0.0005	0.0001
5	0.0067	-0.0098	-0.0020	-0.0005

Section E: STELLAR TABLES

STAR POSITIONS FOR YEAR 1977

DAYS 1 THRU 365 JD 2443144.5 TO 2443509.5 DATES JAN 1 THRU DEC 31

A = 365.00000000 B = -0.00273973

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° '	'	'	'	'	° '
1	1	ALPHA AND	2.1	A0	SHA	358 12.07	-0.21	-0.71	0.35	0.05	358 11.46
		ALPHERATZ			DEC	+28 57.82	0.05	0.30	-0.14	0.14	+28 57.88
2		BETA CAS	2.4	F5	SHA	358 0.87	-0.36	-0.75	0.60	0.09	358 0.05
		CAPH			DEC	+59 1.38	0.05	0.30	-0.11	0.28	+59 1.31
3		GAMMA PEG	2.9	B2	SHA	356 59.27	-0.17	-0.70	0.32	0.04	356 58.71
		ALGENIB			DEC	+15 3.35	0.05	0.30	-0.14	0.06	+15 3.49
4		BETA HYI	2.9	G0	SHA	353 51.55	0.49	-0.43	1.43	0.10	353 51.72
					DEC	-77 23.03	0.04	0.30	-0.00	-0.34	-77 22.51
5	2	ALPHA PHE	2.4	K0	SHA	353 42.77	-0.00	-0.64	0.42	0.03	353 42.42
		ANKAA			DEC	-42 25.85	0.04	0.30	-0.08	-0.25	-42 25.41
6	3	ALPHA CAS	2.3	K0	SHA	350 12.12	-0.34	-0.81	0.57	-0.00	350 11.38
		SCHEDAR			DEC	+56 24.68	0.03	0.29	-0.08	0.27	+56 24.59
7	4	BETA CET	2.2	K0	SHA	349 23.47	-0.09	-0.66	0.33	-0.01	349 23.06
		DIPHDA			DEC	-18 6.75	0.03	0.29	-0.13	-0.13	-18 6.44
8		GAMMA CAS	2-3	B0	SHA	346 10.37	-0.38	-0.86	0.64	-0.05	346 9.61
					DEC	+60 35.55	0.02	0.29	-0.05	0.28	+60 35.43
9		BETA AND	2.4	M0	SHA	342 53.42	-0.23	-0.77	0.38	-0.05	342 52.86
		MIRACH			DEC	+35 29.93	0.02	0.28	-0.09	0.18	+35 29.91
10		DELTA CAS	2.8	A5	SHA	338 55.55	-0.38	-0.92	0.62	-0.14	338 54.84
		RUCHBAH			DEC	+60 6.98	0.01	0.27	-0.02	0.28	+60 6.85
11	5	ALPHA ERI	0.6	B5	SHA	335 47.12	0.09	-0.46	0.57	-0.16	335 47.15
		ACHERNAR			DEC	-57 21.20	-0.00	0.26	-0.13	-0.29	-57 20.78
12		BETA ARI	2.7	A5	SHA	331 39.52	-0.19	-0.75	0.32	-0.12	331 39.08
		SHERATAN			DEC	+20 41.77	-0.01	0.25	-0.09	0.09	+20 41.79
13		ALPHA HYI	3.0	F0	SHA	330 29.32	0.14	-0.37	0.63	-0.24	330 29.52
					DEC	-61 40.88	-0.02	0.25	-0.15	-0.29	-61 40.48
14		GAMMA-1 AND	2.3	K0	SHA	329 22.80	-0.26	-0.85	0.40	-0.16	329 22.28
		ALMAK			DEC	+42 13.20	-0.02	0.25	-0.03	0.20	+42 13.11
15	6	ALPHA ARI	2.2	K2	SHA	328 31.90	-0.19	-0.77	0.32	-0.14	328 31.46
		HAMAL			DEC	+23 21.25	-0.02	0.24	-0.08	0.10	+23 21.25
16		BETA TRI	3.1	A5	SHA	327 57.47	-0.23	-0.82	0.36	-0.16	327 56.99
					DEC	+34 52.75	-0.02	0.24	-0.05	0.16	+34 52.69
17		ALPHA UMI	2.1	F8	SHA	327 42.67	-9.87	-13.12	20.03	-8.93	327 35.17
		POLARIS			DEC	+89 9.57	-0.02	0.24	0.11	0.31	+89 9.35
18	7	THETA ERI	3.4	A2	SHA	315 39.18	-0.02	-0.50	0.35	-0.25	315 39.16
		ACAMAR			DEC	-40 23.77	-0.05	0.20	-0.21	-0.20	-40 23.52
19	8	ALPHA CET	2.8	M0	SHA	314 43.87	-0.14	-0.71	0.26	-0.20	314 43.58
		MENKAR			DEC	+ 4 0.02	-0.05	0.19	-0.12	-0.01	+ 4 0.06
20		BETA PER	2-3	B8	SHA	313 20.00	-0.25	-0.90	0.34	-0.27	313 19.58
		ALGOL			DEC	+40 52.08	-0.06	0.19	0.02	0.16	+40 51.96

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° '	'	'	'	'	° '
21	9	ALPHA PER	1.9	F5	SHA	309 19.92	-0.28	-0.99	0.38	-0.35	309 19.50
		MIRFAK			DEC	+49 46.83	-0.07	0.17	0.07	0.18	+49 46.67
22		ETA TAU	3.0	B5	SHA	303 28.30	-0.19	-0.81	0.24	-0.27	303 27.98
		ALCYONE			DEC	+24 2.10	-0.08	0.14	-0.03	0.07	+24 2.02
23		ZETA PER	2.9	B1	SHA	301 49.77	-0.20	-0.86	0.25	-0.30	301 49.44
					DEC	+31 48.98	-0.08	0.14	0.01	0.10	+31 48.87
24		EPSILON PER	3.0	B1	SHA	300 55.42	-0.23	-0.92	0.28	-0.34	300 55.07
					DEC	+39 56.70	-0.08	0.13	0.05	0.12	+39 56.56
25		GAMMA ERI	3.2	K5	SHA	300 45.67	-0.10	-0.63	0.22	-0.27	300 45.53
					DEC	-13 34.38	-0.09	0.13	-0.18	-0.08	-13 34.33
26	10	ALPHA TAU	1.1	K5	SHA	291 21.02	-0.16	-0.78	0.18	-0.30	291 20.78
		ALDEBARAN			DEC	+16 27.85	-0.10	0.09	-0.05	0.03	+16 27.76
27		IOTA AUR	2.9	K2	SHA	286 7.60	-0.19	-0.88	0.17	-0.37	286 7.33
					DEC	+33 7.87	-0.11	0.06	0.04	0.06	+33 7.72
28		BETA ERI	2.9	A3	SHA	283 19.22	-0.12	-0.66	0.13	-0.31	283 19.08
					DEC	- 5 6.90	-0.12	0.04	-0.16	-0.04	- 5 6.96
29	11	BETA ORI	0.3	B8	SHA	281 38.52	-0.12	-0.65	0.12	-0.32	281 38.40
		RIGEL			DEC	- 8 13.63	-0.12	0.04	-0.17	-0.04	- 8 13.69
30	12	ALPHA AUR	0.2	G0	SHA	281 15.17	-0.22	-1.00	0.17	-0.46	281 14.92
		CAPELLA			DEC	+45 58.57	-0.12	0.03	0.12	0.07	+45 58.39
31	13	GAMMA ORI	1.7	B2	SHA	279 1.55	-0.14	-0.72	0.11	-0.32	279 1.37
		BELLATRIX			DEC	+ 6 19.80	-0.12	0.02	-0.10	-0.01	+ 6 19.70
32	14	BETA TAU	1.8	B8	SHA	278 47.45	-0.17	-0.86	0.12	-0.37	278 47.22
		ELNATH			DEC	+28 35.37	-0.12	0.02	0.02	0.03	+28 35.22
33		BETA LEP	3.0	G0	SHA	278 11.10	-0.10	-0.58	0.11	-0.35	278 11.06
					DEC	-20 46.62	-0.12	0.02	-0.23	-0.06	-20 46.67
34		DELTA ORI	2.5	B0	SHA	277 17.55	-0.13	-0.69	0.10	-0.33	277 17.40
					DEC	- 0 18.90	-0.12	0.01	-0.14	-0.03	- 0 18.99
35		ALPHA LEP	2.7	F0	SHA	277 4.27	-0.11	-0.59	0.10	-0.34	277 4.21
					DEC	-17 50.27	-0.13	0.01	-0.22	-0.05	-17 50.33
36		IOTA ORI	2.9	O5	SHA	276 25.40	-0.12	-0.66	0.10	-0.33	276 25.28
					DEC	- 5 55.43	-0.13	0.01	-0.16	-0.03	- 5 55.52
37	15	EPSILON ORI	1.7	B0	SHA	276 14.32	-0.13	-0.68	0.10	-0.33	276 14.18
		ALNILAM			DEC	- 1 12.93	-0.13	0.01	-0.14	-0.03	- 1 13.03
38		ZETA TAU	3.0	B3	SHA	275 55.95	-0.16	-0.81	0.10	-0.35	275 55.74
					DEC	+21 7.78	-0.13	0.01	-0.02	0.01	+21 7.65
39		ALPHA COL	2.7	B5	SHA	275 17.77	-0.08	-0.49	0.11	-0.40	275 17.84
		PHACT			DEC	-34 5.13	-0.13	0.00	-0.28	-0.07	-34 5.19
40		ZETA ORI	2.0	B0	SHA	275 6.05	-0.13	-0.68	0.09	-0.33	275 5.91
		ALNITAK			DEC	- 1 57.22	-0.13	0.00	-0.14	-0.03	- 1 57.32
41		KAPPA ORI	2.2	B0	SHA	273 20.02	-0.12	-0.64	0.08	-0.34	273 19.92
					DEC	- 9 40.60	-0.13	-0.01	-0.18	-0.04	- 9 40.70
42	16	ALPHA ORI	0-1	M0	SHA	271 31.10	-0.14	-0.73	0.07	-0.34	271 30.93
		BETELGEUSE			DEC	+ 7 24.23	-0.13	-0.02	-0.09	-0.02	+ 7 24.11
43		BETA AUR	2.1	A0	SHA	270 32.37	-0.19	-0.99	0.09	-0.47	270 32.16
		MENKALINAN			DEC	+44 56.80	-0.13	-0.02	0.12	0.03	+44 56.63

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° ′	′	′	′	′	° ′
44		THETA AUR	2.7	A0	SHA	270 27.70	-0.18	-0.92	0.08	-0.42	270 27.49
					DEC	+37 12.73	-0.13	-0.02	0.08	0.02	+37 12.57
45		BETA CMA MIRZAM	2.0	B1	SHA	264 34.70	-0.12	-0.60	0.03	-0.36	264 34.64
					DEC	-17 56.62	-0.14	-0.05	-0.22	-0.03	-17 56.75
46	17	ALPHA CAR CANOPUS	-0.9	F0	SHA	264 8.37	-0.07	-0.30	0.05	-0.56	264 8.71
					DEC	-52 40.97	-0.14	-0.06	-0.33	-0.03	-52 41.10
47		GAMMA GEM ALHENA	1.9	A0	SHA	260 54.25	-0.14	-0.78	0.01	-0.36	260 54.07
					DEC	+16 25.20	-0.14	-0.07	-0.04	-0.02	+16 25.05
48	18	ALPHA CMA A SIRIUS	-1.6	A0	SHA	258 58.02	-0.12	-0.60	0.00	-0.36	258 57.96
					DEC	-16 41.05	-0.14	-0.08	-0.22	-0.02	-16 41.21
49		TAU PUP	2.8	K0	SHA	257 39.52	-0.10	-0.34	-0.01	-0.54	257 39.79
					DEC	-50 35.20	-0.14	-0.09	-0.33	-0.00	-50 35.38
50	19	EPSILON CMA ADHARA	1.6	B1	SHA	255 34.17	-0.12	-0.53	-0.02	-0.39	255 34.18
					DEC	-28 56.40	-0.14	-0.10	-0.27	-0.01	-28 56.58
51		OMICRON-2 CMA	3.1	B5	SHA	254 29.05	-0.12	-0.57	-0.02	-0.37	254 29.01
					DEC	-23 47.93	-0.14	-0.11	-0.25	-0.01	-23 48.12
52		DELTA CMA WEZEN	2.0	F8	SHA	253 8.17	-0.12	-0.55	-0.03	-0.38	253 8.15
					DEC	-26 21.35	-0.14	-0.11	-0.26	-0.00	-26 21.55
53		PI PUP	2.7	K5	SHA	250 55.05	-0.12	-0.48	-0.05	-0.42	250 55.11
					DEC	-37 3.33	-0.14	-0.12	-0.29	0.01	-37 3.55
54		ETA CMA	2.4	B5	SHA	249 12.22	-0.13	-0.54	-0.06	-0.38	249 12.21
					DEC	-29 15.45	-0.14	-0.13	-0.27	0.01	-29 15.67
55		BETA CMI	3.1	B8	SHA	248 31.45	-0.13	-0.73	-0.06	-0.34	248 31.29
					DEC	+ 8 20.20	-0.14	-0.13	-0.09	-0.03	+ 8 20.02
56		SIGMA PUP	3.3	K5	SHA	247 52.50	-0.13	-0.44	-0.08	-0.46	247 52.61
					DEC	-43 15.27	-0.14	-0.14	-0.31	0.03	-43 15.51
57		ALPHA GEM A CASTOR	2.0	A0	SHA	246 43.02	-0.13	-0.86	-0.08	-0.39	246 42.86
					DEC	+31 56.42	-0.14	-0.14	0.05	-0.06	+31 56.26
58		ALPHA GEM B	2.8	A0	SHA	246 42.97	-0.13	-0.86	-0.08	-0.39	246 42.81
					DEC	+31 56.40	-0.14	-0.14	0.05	-0.06	+31 56.25
59	20	ALPHA CMI A PROCYON	0.5	F5	SHA	245 28.52	-0.13	-0.72	-0.07	-0.33	245 28.37
					DEC	+ 5 17.08	-0.14	-0.15	-0.10	-0.03	+ 5 16.90
60	21	BETA GEM POLLUX	1.2	K0	SHA	244 1.35	-0.13	-0.83	-0.09	-0.37	244 1.18
					DEC	+28 4.97	-0.14	-0.15	0.03	-0.07	+28 4.81
61		ZETA PUP	2.3	O	SHA	239 18.38	-0.15	-0.49	-0.14	-0.41	239 18.40
					DEC	-39 56.27	-0.14	-0.18	-0.29	0.06	-39 56.56
62		RHO PUP	2.9	F5	SHA	238 21.55	-0.14	-0.58	-0.12	-0.35	238 21.46
					DEC	-24 14.23	-0.14	-0.18	-0.24	0.03	-24 14.50
63		GAMMA-2 VEL	1.9	O	SHA	237 47.65	-0.16	-0.43	-0.16	-0.46	237 47.74
					DEC	-47 16.10	-0.14	-0.18	-0.31	0.08	-47 16.41
64	22	EPSILON CAR AVIOR	1.7	*	SHA	234 29.35	-0.18	-0.30	-0.25	-0.60	234 29.62
					DEC	-59 26.12	-0.14	-0.20	-0.32	0.12	-59 26.47
65		DELTA VEL	2.0	A0	SHA	228 58.97	-0.19	-0.40	-0.27	-0.50	228 59.09
					DEC	-54 37.42	-0.14	-0.22	-0.30	0.13	-54 37.79
66		IOTA UMA	3.1	A5	SHA	225 35.40	-0.07	-0.91	-0.26	-0.42	225 35.29
					DEC	+48 7.97	-0.13	-0.23	0.11	-0.16	+48 7.88

ID	NAV	NAME	MAG	SP		MEAN PLACE		H	R	S	C	APPNT PLACE	
						°	'	'	'	'	'	°	
67	23	LAMBDA VEL	2.2	K5	SHA	223	12.77	-0.19	-0.51	-0.25	-0.37	223	12.71
		SUHAIL			DEC	-43	20.35	-0.13	-0.24	-0.27	0.12	-43	20.72
68	24	BETA CAR	1.8	A0	SHA	221	45.67	-0.30	-0.20	-0.54	-0.77	221	46.04
		MIAPLACIDUS			DEC	-69	37.35	-0.13	-0.24	-0.28	0.19	-69	37.79
69		IOTA CAR	2.2	F0	SHA	220	52.88	-0.24	-0.39	-0.37	-0.51	220	52.95
					DEC	-59	10.72	-0.13	-0.24	-0.28	0.17	-59	11.14
70		KAPPA VEL	2.6	B3	SHA	219	39.00	-0.23	-0.45	-0.34	-0.45	219	39.00
					DEC	-54	54.73	-0.13	-0.25	-0.28	0.17	-54	55.15
71	25	ALPHA HYA	2.2	K2	SHA	218	23.15	-0.14	-0.67	-0.21	-0.26	218	22.93
		ALPHARD			DEC	- 8	33.50	-0.13	-0.25	-0.17	0.01	- 8	33.76
72		N VEL	3.0	K5	SHA	217	22.17	-0.24	-0.44	-0.38	-0.46	217	22.17
					DEC	-56	55.95	-0.13	-0.25	-0.27	0.18	-56	56.38
73		EPSILON LEO	3.1	G0	SHA	213	51.77	-0.10	-0.76	-0.24	-0.26	213	51.56
					DEC	+23	52.85	-0.12	-0.26	-0.03	-0.12	+23	52.72
74	26	ALPHA LEO	1.3	B8	SHA	208	12.77	-0.11	-0.72	-0.25	-0.21	208	12.52
		REGULUS			DEC	+12	4.80	-0.11	-0.28	-0.09	-0.08	+12	4.63
75		GAMMA-1 LEO	2.6	K0	SHA	205	19.40	-0.10	-0.73	-0.27	-0.21	205	19.15
		ALGEIBA			DEC	+19	57.50	-0.11	-0.28	-0.06	-0.12	+19	57.37
76		THETA CAR	3.0	B0	SHA	199	28.00	-0.35	-0.53	-0.62	-0.38	199	27.76
					DEC	-64	16.42	-0.10	-0.29	-0.20	0.26	-64	16.92
77		MU VEL	2.8	G5	SHA	198	33.35	-0.26	-0.61	-0.42	-0.25	198	33.04
					DEC	-49	17.90	-0.10	-0.29	-0.21	0.21	-49	18.35
78		BETA UMA	2.4	A0	SHA	194	53.05	0.04	-0.77	-0.51	-0.26	194	52.96
		MERAK			DEC	+56	30.35	-0.09	-0.30	0.04	-0.27	+56	30.38
79	27	ALPHA UMA	1.9	K0	SHA	194	25.20	0.08	-0.78	-0.60	-0.30	194	25.19
		DUBHE			DEC	+61	52.52	-0.09	-0.30	0.06	-0.29	+61	52.57
80		PSI UMA	3.1	K0	SHA	192	54.38	-0.02	-0.73	-0.40	-0.18	192	54.18
					DEC	+44	37.40	-0.09	-0.30	-0.00	-0.24	+44	37.40
81		DELTA LEO	2.6	A3	SHA	191	46.70	-0.09	-0.70	-0.31	-0.13	191	46.39
					DEC	+20	38.98	-0.08	-0.30	-0.08	-0.14	+20	38.89
82	28	BETA LEO	2.2	A2	SHA	183	1.70	-0.10	-0.69	-0.31	-0.08	183	1.34
		DENEBOLA			DEC	+14	42.03	-0.06	-0.30	-0.11	-0.11	+14	41.93
83		GAMMA UMA	2.5	A0	SHA	181	50.60	0.05	-0.67	-0.52	-0.12	181	50.43
		PHECDA			DEC	+53	49.35	-0.06	-0.30	-0.02	-0.28	+53	49.42
84		DELTA CEN	2.9	B3	SHA	178	12.60	-0.30	-0.73	-0.49	-0.07	178	12.01
					DEC	-50	35.67	-0.05	-0.30	-0.13	0.24	-50	36.11
85	29	GAMMA CRV	2.8	B8	SHA	176	20.70	-0.17	-0.71	-0.33	-0.04	176	20.21
		GIENAH			DEC	-17	24.87	-0.05	-0.30	-0.14	0.08	-17	25.14
86	30	ALPHA CRU A	1.6	B1	SHA	173	40.38	-0.40	-0.81	-0.69	-0.04	173	39.61
		ACRUX			DEC	-62	58.30	-0.04	-0.30	-0.09	0.29	-62	58.78
87		ALPHA CRU B	2.1	B3	SHA	173	40.25	-0.40	-0.81	-0.69	-0.04	173	39.49
					DEC	-62	58.33	-0.04	-0.30	-0.09	0.29	-62	58.81
88	31	GAMMA CRU	1.6	M3	SHA	172	31.80	-0.35	-0.79	-0.58	-0.02	172	31.08
		GACRUX			DEC	-56	59.08	-0.04	-0.29	-0.09	0.27	-56	59.54
89		BETA CRV	2.8	G5	SHA	171	42.38	-0.19	-0.72	-0.34	-0.01	171	41.83
					DEC	-23	16.18	-0.04	-0.29	-0.13	0.11	-23	16.48

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° '	'	'	'	'	° '
90		ALPHA MUS	2.9	B3	SHA	171 3.05	-0.50	-0.88	-0.88	-0.01	171 2.13
					DEC	-69 0.53	-0.04	-0.29	-0.06	0.31	-69 1.02
91		GAMMA CEN	2.4	A0	SHA	169 56.40	-0.29	-0.78	-0.48	0.00	169 55.71
		MUHLIFAIN			DEC	-48 50.02	-0.03	-0.29	-0.09	0.24	-48 50.44
92		GAMMA VIR	2.9	F0	SHA	169 52.60	-0.13	-0.69	-0.31	0.00	169 52.12
					DEC	- 1 19.42	-0.03	-0.29	-0.13	-0.02	- 1 19.58
93		BETA CRU	1.5	B1	SHA	168 24.50	-0.37	-0.84	-0.62	0.02	168 23.69
		MIMOSA			DEC	-59 33.80	-0.03	-0.29	-0.07	0.28	-59 34.25
94	32	EPSILON UMA	1.7	A0	SHA	166 44.67	0.08	-0.55	-0.56	0.04	166 44.44
		ALIOTH			DEC	+56 5.07	-0.02	-0.29	-0.08	-0.30	+56 5.19
95		ALPHA-2 CVN	2.9	A0	SHA	166 15.70	-0.02	-0.61	-0.40	0.03	166 15.34
		COR CAROLI			DEC	+38 26.53	-0.02	-0.29	-0.11	-0.23	+38 26.60
96		EPSILON VIR	2.9	K0	SHA	164 44.52	-0.10	-0.67	-0.32	0.03	164 44.05
					DEC	+11 4.95	-0.02	-0.28	-0.14	-0.09	+11 4.88
97		IOTA CEN	2.9	A2	SHA	160 10.52	-0.24	-0.78	-0.39	0.07	160 9.82
					DEC	-36 35.48	-0.01	-0.27	-0.08	0.18	-36 35.81
98		ZETA UMA	2.4	A2	SHA	159 14.97	0.08	-0.50	-0.54	0.11	159 14.68
		MIZAR			DEC	+55 2.70	-0.01	-0.27	-0.12	-0.29	+55 2.85
99	33	ALPHA VIR	1.2	B2	SHA	159 0.32	-0.16	-0.72	-0.32	0.07	158 59.74
		SPICA			DEC	-11 2.50	-0.01	-0.27	-0.12	0.04	-11 2.68
100		EPSILON CEN	2.6	B1	SHA	155 23.70	-0.33	-0.89	-0.51	0.15	155 22.78
					DEC	-53 21.00	0.00	-0.26	-0.02	0.25	-53 21.38
101	34	ETA UMA	1.9	B3	SHA	153 20.47	0.04	-0.51	-0.47	0.15	153 20.11
		ALKAID			DEC	+49 25.65	0.01	-0.26	-0.15	-0.26	+49 25.79
102		ETA BOO	2.8	G0	SHA	151 36.17	-0.08	-0.64	-0.32	0.12	151 35.66
					DEC	+18 30.73	0.01	-0.25	-0.16	-0.13	+18 30.75
103		ZETA CEN	3.1	B2	SHA	151 28.55	-0.29	-0.87	-0.44	0.16	151 27.67
					DEC	-47 10.55	0.01	-0.25	-0.02	0.22	-47 10.88
104	35	BETA CEN	0.9	B1	SHA	149 27.20	-0.38	-1.00	-0.60	0.24	149 26.07
		HADAR			DEC	-60 15.77	0.02	-0.25	0.02	0.26	-60 16.14
105	36	THETA CEN	2.3	K0	SHA	148 40.15	-0.24	-0.82	-0.37	0.16	148 39.35
		MENKENT			DEC	-36 15.45	0.02	-0.24	-0.04	0.17	-36 15.72
106	37	ALPHA BOO	0.2	K0	SHA	146 20.82	-0.08	-0.63	-0.31	0.15	146 20.28
		ARCTURUS			DEC	+19 18.08	0.03	-0.24	-0.17	-0.13	+19 18.12
107		GAMMA BOO	3.0	F0	SHA	142 12.72	-0.02	-0.53	-0.36	0.20	142 12.24
					DEC	+38 24.48	0.04	-0.22	-0.19	-0.21	+38 24.62
108		ETA CEN	2.6	*	SHA	141 29.40	-0.26	-0.88	-0.38	0.22	141 28.48
					DEC	-42 3.45	0.04	-0.22	-0.00	0.18	-42 3.70
109	38	ALPHA CEN A	0.3	G0	SHA	140 29.42	-0.38	-1.07	-0.57	0.35	140 28.16
		RIGEL KENT.			DEC	-60 44.33	0.04	-0.22	0.06	0.25	-60 44.65
110		ALPHA CEN B	1.7	K5	SHA	140 29.77	-0.38	-1.07	-0.57	0.35	140 28.51
					DEC	-60 44.65	0.04	-0.22	0.06	0.25	-60 44.96
111		ALPHA LUP	2.9	B2	SHA	139 54.13	-0.28	-0.92	-0.41	0.25	139 53.13
					DEC	-47 17.43	0.04	-0.21	0.02	0.20	-47 17.70
112		EPSILON BOO	2.7	K0	SHA	139 0.27	-0.06	-0.58	-0.31	0.20	138 59.73
					DEC	+27 10.22	0.04	-0.21	-0.19	-0.16	+27 10.31

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° '	'	'	'	'	° '
113	39	ALPHA-2 LIB	2.9	A3	SHA	137 35.97	-0.17	-0.75	-0.28	0.19	137 35.24
		ZUBENELGENUBI			DEC	-15 56.83	0.05	-0.20	-0.08	0.05	-15 56.94
114	40	BETA UMI	2.2	K5	SHA	137 18.65	0.35	0.10	-0.99	0.68	137 18.37
		KOCHAB			DEC	+74 14.97	0.05	-0.20	-0.19	-0.28	+74 15.20
115		BETA LUP	2.8	B2	SHA	135 44.75	-0.26	-0.90	-0.36	0.26	135 43.78
					DEC	-43 2.55	0.05	-0.20	0.02	0.17	-43 2.77
116		BETA LIB	2.7	B8	SHA	131 3.50	-0.15	-0.73	-0.25	0.22	131 2.76
					DEC	- 9 17.95	0.06	-0.18	-0.10	0.02	- 9 17.99
117		GAMMA TRA	3.1	A0	SHA	130 48.88	-0.46	-1.31	-0.68	0.59	130 47.16
					DEC	-68 35.77	0.06	-0.18	0.13	0.24	-68 36.03
118		GAMMA UMI	3.1	A2	SHA	129 48.70	0.26	0.07	-0.79	0.71	129 48.28
					DEC	+71 54.95	0.07	-0.17	-0.23	-0.25	+71 55.18
119		GAMMA LUP	2.9	B3	SHA	126 35.97	-0.24	-0.92	-0.31	0.31	126 34.96
					DEC	-41 5.43	0.07	-0.16	0.04	0.14	-41 5.58
120	41	ALPHA CRB	2.3	A0	SHA	126 34.30	-0.07	-0.56	-0.26	0.26	126 33.69
		ALPHECCA			DEC	+26 47.47	0.07	-0.16	-0.21	-0.13	+26 47.59
121		ALPHA SER	2.7	K0	SHA	124 13.00	-0.12	-0.66	-0.23	0.25	124 12.30
					DEC	+ 6 29.82	0.08	-0.15	-0.16	-0.05	+ 6 29.87
122		BETA TRA	3.0	F0	SHA	121 43.47	-0.37	-1.23	-0.48	0.57	121 41.92
					DEC	-63 21.68	0.08	-0.14	0.15	0.19	-63 21.86
123		PI SCO	3.0	B2	SHA	120 38.15	-0.19	-0.82	-0.23	0.29	120 37.26
					DEC	-26 2.95	0.09	-0.13	-0.02	0.07	-26 3.00
124		DELTA SCO	2.5	B0	SHA	120 15.45	-0.18	-0.80	-0.23	0.28	120 14.59
		DSCHUBBA			DEC	-22 33.45	0.09	-0.13	-0.03	0.06	-22 33.49
125		BETA-1 SCO	2.9	B1	SHA	118 58.55	-0.17	-0.79	-0.22	0.28	118 57.70
					DEC	-19 44.62	0.09	-0.12	-0.04	0.05	-19 44.64
126		DELTA OPH	3.0	M0	SHA	116 42.93	-0.14	-0.71	-0.19	0.27	116 42.16
					DEC	- 3 38.18	0.09	-0.11	-0.12	-0.01	- 3 38.13
127		ETA DRA	2.9	G5	SHA	114 4.88	0.06	-0.17	-0.38	0.59	114 4.26
					DEC	+61 33.95	0.10	-0.10	-0.29	-0.18	+61 34.18
128	42	ALPHA SCO A	1.2	M0	SHA	113 0.10	-0.18	-0.83	-0.20	0.32	112 59.18
		ANTARES			DEC	-26 22.93	0.10	-0.09	-0.00	0.06	-26 22.94
129		BETA HER	2.8	K0	SHA	112 41.55	-0.09	-0.58	-0.19	0.31	112 40.86
					DEC	+21 32.32	0.10	-0.09	-0.22	-0.09	+21 32.46
130		TAU SCO	2.9	B0	SHA	111 23.30	-0.19	-0.85	-0.19	0.33	111 22.36
					DEC	-28 10.18	0.10	-0.09	0.01	0.06	-28 10.18
131		ZETA OPH	2.7	B0	SHA	111 1.65	-0.15	-0.75	-0.17	0.30	111 0.83
					DEC	-10 31.30	0.10	-0.08	-0.08	0.01	-10 31.25
132		ZETA HER	3.0	G0	SHA	109 53.72	-0.07	-0.51	-0.19	0.35	109 53.05
					DEC	+31 38.62	0.11	-0.08	-0.25	-0.11	+31 38.79
133	43	ALPHA TRA	1.9	K2	SHA	108 26.77	-0.38	-1.45	-0.44	0.84	108 24.83
		ATRIA			DEC	-68 59.25	0.11	-0.07	0.21	0.14	-68 59.32
134		EPSILON SCO	2.4	K0	SHA	107 49.95	-0.20	-0.89	-0.19	0.37	107 48.94
					DEC	-34 15.17	0.11	-0.07	0.04	0.07	-34 15.16
135		ZETA ARA	3.1	K5	SHA	105 49.35	-0.27	-1.13	-0.26	0.55	105 47.97
					DEC	-55 57.33	0.11	-0.06	0.16	0.11	-55 57.36

ID	NAV	NAME	MAG	SP		MEAN PLACE		H	R	S	C	APPNT PLACE	
						°	'	'	'	'	'	°	'
136	44	ETA OPH	2.6	A2	SHA	102	44.15	-0.16	-0.78	-0.13	0.33	102	43.28
		SABIK			DEC	-15	41.87	0.12	-0.04	-0.05	0.01	-15	41.78
137		ALPHA HER	3-4	M3	SHA	101	36.05	-0.11	-0.61	-0.13	0.33	101	35.30
					DEC	+14	24.93	0.12	-0.04	-0.20	-0.05	+14	25.09
138		BETA ARA	2.8	K2	SHA	99	9.25	-0.24	-1.13	-0.20	0.57	99	7.87
					DEC	-55	30.60	0.12	-0.02	0.17	0.08	-55	30.57
139		UPSILON SCO	2.8	B3	SHA	97	42.05	-0.19	-0.92	-0.13	0.41	97	40.99
					DEC	-37	16.75	0.12	-0.01	0.07	0.04	-37	16.67
140		BETA DRA	3.0	G0	SHA	97	31.32	-0.04	-0.30	-0.17	0.53	97	30.61
					DEC	+52	19.07	0.12	-0.01	-0.32	-0.09	+52	19.28
141		ALPHA ARA	3.0	B3	SHA	97	29.10	-0.22	-1.05	-0.16	0.50	97	27.85
					DEC	-49	51.58	0.12	-0.01	0.14	0.06	-49	51.53
142	45	LAMBDA SCO	1.7	B2	SHA	96	59.33	-0.19	-0.92	-0.12	0.41	96	58.27
		SHAULA			DEC	-37	5.32	0.13	-0.01	0.07	0.04	-37	5.24
143	46	ALPHA OPH	2.1	A5	SHA	96	32.03	-0.12	-0.62	-0.10	0.34	96	31.26
		RASALHAGUE			DEC	+12	34.53	0.13	-0.01	-0.20	-0.04	+12	34.70
144		THETA SCO	2.0	F0	SHA	96	5.05	-0.20	-0.97	-0.13	0.45	96	3.92
					DEC	-42	59.08	0.13	-0.01	0.11	0.04	-42	59.01
145		KAPPA SCO	2.5	B2	SHA	94	46.60	-0.19	-0.94	-0.11	0.42	94	45.52
					DEC	-39	1.18	0.13	0.00	0.09	0.03	-39	1.09
146		BETA OPH	2.9	K0	SHA	94	24.98	-0.13	-0.67	-0.09	0.33	94	24.18
					DEC	+ 4	34.53	0.13	0.00	-0.16	-0.03	+ 4	34.69
147	47	GAMMA DRA	2.4	K5	SHA	90	58.95	-0.06	-0.31	-0.11	0.54	90	58.20
		ELTANIN			DEC	+51	29.47	0.13	0.02	-0.32	-0.06	+51	29.67
148		GAMMA SGR	3.1	K0	SHA	88	55.05	-0.16	-0.87	-0.07	0.39	88	54.06
					DEC	-30	25.55	0.13	0.03	0.04	0.00	-30	25.40
149		DELTA SGR	2.8	K0	SHA	85	7.20	-0.16	-0.86	-0.04	0.39	85	6.22
					DEC	-29	50.37	0.14	0.05	0.04	-0.01	-29	50.20
150	48	EPSILON SGR	1.9	A0	SHA	84	20.32	-0.16	-0.89	-0.04	0.41	84	19.30
		KAUS AUST.			DEC	-34	23.82	0.14	0.06	0.07	-0.01	-34	23.64
151		LAMBDA SGR	2.9	K0	SHA	83	21.75	-0.15	-0.83	-0.03	0.38	83	20.81
					DEC	-25	26.15	0.14	0.06	0.01	-0.01	-25	25.97
152	49	ALPHA LYR	0.1	A0	SHA	80	57.63	-0.10	-0.46	-0.02	0.44	80	56.86
		VEGA			DEC	+38	45.68	0.14	0.07	-0.30	-0.02	+38	45.88
153	50	SIGMA SGR	2.1	B3	SHA	76	32.43	-0.14	-0.83	0.01	0.38	76	31.49
		NUNKI			DEC	-26	19.60	0.14	0.10	0.02	-0.03	-26	19.38
154		ZETA SGR	2.7	A2	SHA	74	42.77	-0.14	-0.85	0.02	0.39	74	41.81
					DEC	-29	54.87	0.14	0.10	0.04	-0.04	-29	54.63
155		ZETA AQL	3.0	A0	SHA	73	54.73	-0.13	-0.62	0.03	0.35	73	53.94
					DEC	+13	49.68	0.14	0.11	-0.20	-0.02	+13	49.90
156		PI SGR	3.0	F2	SHA	72	54.07	-0.14	-0.80	0.03	0.36	72	53.18
					DEC	-21	3.70	0.14	0.11	-0.01	-0.04	-21	3.46
157		BETA-1 CYG	3.2	*	SHA	67	33.13	-0.13	-0.55	0.07	0.38	67	32.34
		ALBIREO			DEC	+27	54.62	0.14	0.14	-0.26	0.01	+27	54.82
158		DELTA CYG	3.0	A0	SHA	63	56.20	-0.14	-0.43	0.11	0.46	63	55.38
					DEC	+45	4.43	0.14	0.16	-0.31	0.05	+45	4.61

ID	NAV	NAME	MAG	SP		MEAN PLACE	H	R	S	C	APPNT PLACE
						° '	'	'	'	'	° '
159		GAMMA AQL	2.8	K2	SHA	63 42.53	-0.13	-0.64	0.08	0.33	63 41.74
					DEC	+10 33.37	0.14	0.16	-0.19	-0.01	+10 33.60
160	51	ALPHA AQL	0.9	A5	SHA	62 35.10	-0.13	-0.65	0.09	0.33	62 34.31
		ALTAIR			DEC	+ 8 48.40	0.14	0.16	-0.18	-0.01	+ 8 48.63
161		GAMMA CYG	2.3	F8	SHA	54 38.98	-0.16	-0.50	0.17	0.40	54 38.17
					DEC	+40 10.93	0.14	0.19	-0.29	0.08	+40 11.10
162	52	ALPHA PAV	2.1	B3	SHA	54 2.48	-0.08	-1.04	0.24	0.56	54 1.31
		PEACOCK			DEC	-56 48.62	0.14	0.20	0.17	-0.14	-56 48.24
163		ALPHA IND	3.2	K0	SHA	51 0.70	-0.09	-0.93	0.21	0.44	50 59.71
					DEC	-47 22.38	0.14	0.21	0.11	-0.14	-47 22.00
164	53	ALPHA CYG	1.3	A2	SHA	49 50.30	-0.17	-0.48	0.21	0.42	49 49.47
		DENEB			DEC	+45 11.85	0.14	0.21	-0.29	0.11	+45 11.99
165		EPSILON CYG	2.6	K0	SHA	48 40.83	-0.16	-0.55	0.19	0.35	48 40.04
					DEC	+33 53.00	0.14	0.22	-0.26	0.08	+33 53.17
166		ALPHA CEP	2.6	A5	SHA	40 29.55	-0.25	-0.35	0.42	0.57	40 28.55
		ALDERAMIN			DEC	+62 29.27	0.13	0.25	-0.28	0.18	+62 29.34
167		BETA AQR	3.1	G0	SHA	37 24.78	-0.12	-0.71	0.21	0.25	37 24.05
					DEC	- 5 40.38	0.13	0.25	-0.11	-0.05	- 5 40.08
168	54	EPSILON PEG	2.5	K0	SHA	34 14.18	-0.14	-0.67	0.22	0.24	34 13.46
		ENIF			DEC	+ 9 46.13	0.12	0.26	-0.17	0.02	+ 9 46.37
169		DELTA CAP	3.0	A5	SHA	33 33.43	-0.11	-0.73	0.23	0.24	33 32.71
					DEC	-16 13.93	0.12	0.26	-0.07	-0.09	-16 13.59
170	55	ALPHA GRU	2.2	B5	SHA	28 18.18	-0.03	-0.82	0.35	0.31	28 17.42
		AL NA'IR			DEC	-47 4.38	0.11	0.28	0.06	-0.21	-47 3.92
171		ALPHA TUC	2.9	K2	SHA	25 45.95	0.04	-0.88	0.51	0.40	25 45.15
					DEC	-60 22.50	0.11	0.28	0.10	-0.25	-60 22.00
172		BETA GRU	2.2	M3	SHA	19 40.53	-0.02	-0.77	0.39	0.24	19 39.88
					DEC	-47 0.33	0.10	0.29	0.03	-0.23	-46 59.85
173	56	ALPHA PSA	1.3	A3	SHA	15 54.28	-0.07	-0.72	0.32	0.17	15 53.68
		FOMALHAUT			DEC	-29 44.67	0.09	0.30	-0.04	-0.17	-29 44.25
174		BETA PEG	2.6	M0	SHA	14 20.15	-0.19	-0.67	0.32	0.16	14 19.47
		SCHEAT			DEC	+27 57.47	0.09	0.30	-0.18	0.12	+27 57.58
175	57	ALPHA PEG	2.6	A0	SHA	14 5.80	-0.16	-0.68	0.29	0.14	14 5.16
		MARKAB			DEC	+15 4.87	0.09	0.30	-0.16	0.06	+15 5.05
176		GAMMA CEP	3.4	K0	SHA	5 24.15	-0.71	-0.68	1.39	0.41	5 22.70
					DEC	+77 30.23	0.07	0.30	-0.12	0.32	+77 30.14

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